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TABLETS OF ANATOMY

BY
GEORGE COOKE, F.R.C.S.
AND
E. H. SIEVEKING, M.D.

FOURTH EDITION

PART II.—OF THE ARTICULATIONS

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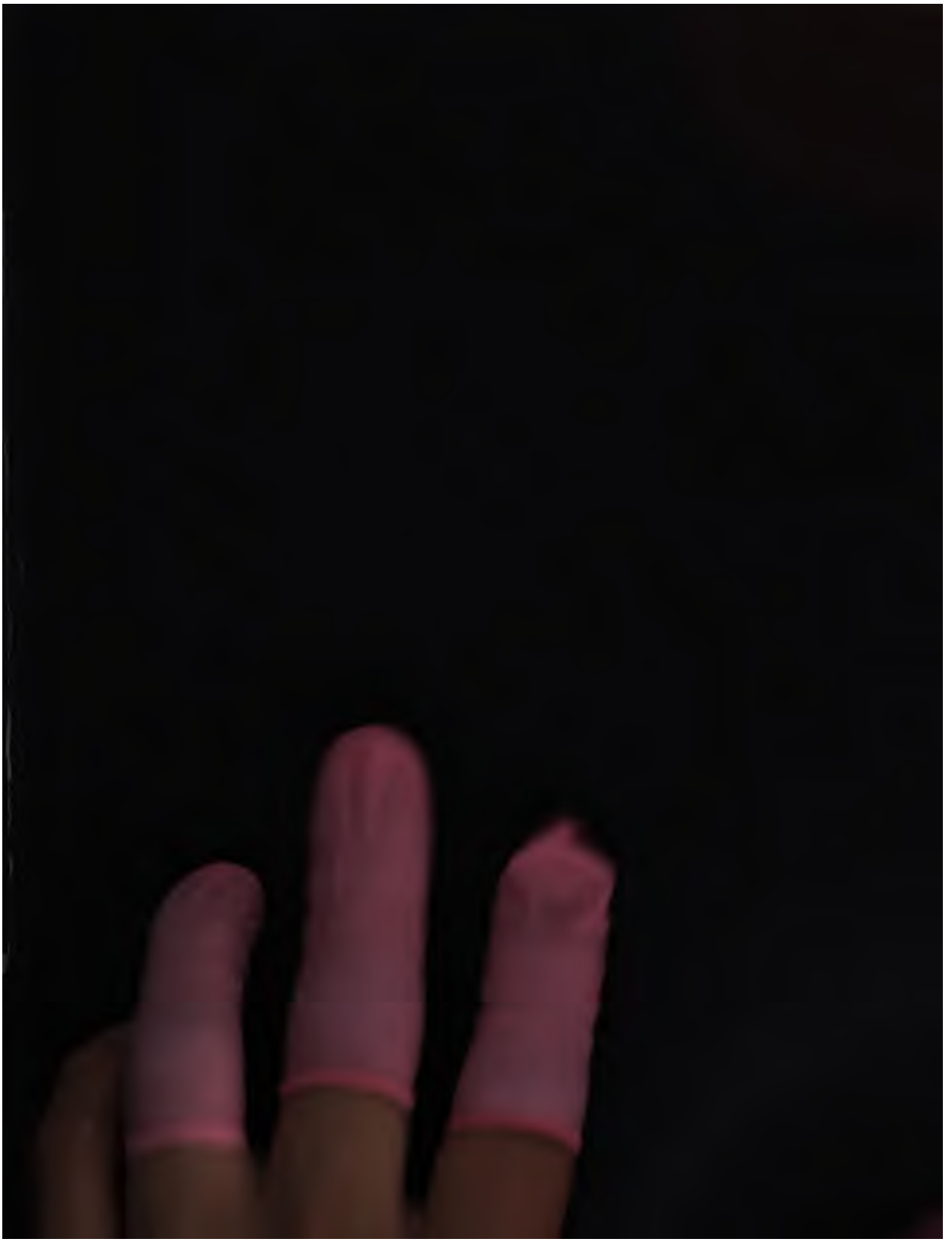

TABLETS

OF

ANATOMY.

DISSECTIONAL AND SCIENTIFIC.

BY

THOMAS COOKE, F.R.C.S., Eng.;

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AND

F. G. HAMILTON COOKE.

PART II.—LIMBS, ABDOMEN, PELVIS.

(*With 254 Illustrations.*)

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TO

ELLIS, HEATH, AND HOLDEN,

AND TO THE MEMORY OF

HENRY GRAY,

MEN TO WHOM, IN THIS COUNTRY, AS TO

CRUVEILHIER, HIRSCHFELD, AND CONSTANT SAPPEY

ABROAD,

WE OWE THE SUREST FOUNDATION OF OUR ART,

A PRACTICAL KNOWLEDGE OF HUMAN ANATOMY.

"I regret to find that the teaching of Anatomy is getting more and more into the hands of professors who are not surgeons, and that their tendency is to lay stress on transcendental details rather than on surgical relations."—*Christopher Heath.*

"We may be training a school of more or less scientific anatomists, but we are not insisting on such a curriculum of study, and on such examinations, as will produce in the future well-grounded, thoroughly practical, and efficient medical men. . . . Those scientific anatomists, who concern themselves with other vertebrates, and who, apparently, treat of an ideal evolutionised human body of their own creation, have no experience of the requirements of those who are destined to medical practice."—*The Lancet.*

"The influence on the legitimate teacher is injurious. He has to bend to it, and becomes a lecture-room grinder."—*Professor (now Sir John) Struthers.*

TO

MACALISTER, CUNNINGHAM, BLAND SUTTON,

AND THE EDITORS OF "QUAIN" AND "MORRIS,"

WHOSE MOST INTERESTING VIEWS ARE LARGELY PRESENTED SIDE BY SIDE WITH THOSE OF THE ABOVE NAMED ANATOMISTS.

Already in the forties, it was recognised by Continental authorities that anatomists had little more to discover by the aid of the scalpel; and the

11915

opinion generally accepted that the Progressists had but histological research before them, – a view taken up by Cruveilhier.

The view has been falsified to this extent, that to Histology, which has largely branched off as an independent science, there have been added, as fields of research for anatomists, – anatomists now largely *in name*, – Embryology, and that indefinite and ever-extending body of doctrine which we call Morphology.

On this soil, "Anatomy" is now luxuriating like an exotic.

But "anatomists" have lost touch with the human "subject:" Their work is authoritatively described as "transcendental."

A scission is upon us.

It must lead to this:

On the one hand, we shall have Anatomy – divested of everything not simply and purely dissectional, of everything that was never HERS; but, as such, once more recognised as the ALMA MATER of EVERYTHING MEDICAL: The Newest Anatomy will be the Old Anatomy, – tried, purified, *not* found wanting, – reinstated in her singular position of honour, rightly associated with the names first given.

But side by side with this Anatomy, there will be brought forth a Science, already budding into existence, but which is not yet correctly and definitely named, – *it is* NOT *Anatomy*, – which will satisfy the worthiest aspirations in the direction of progress.

There are to-day two intersecting lines of thought, two largely disagreeing currents, – the new scientific, or *theoretical*, – and the old *practical*. These must be brought into parallelism.

"He (Mr. Cooke) would have teachers and examiners, not specialists, but men of a general knowledge of both anatomy and physiology. This would result in a much sounder valuation of the details of both subjects, and would improve the character of the examination."—*British Medical Journal.*

"Mr. Cooke has done good service in bringing this subject prominently before the profession. It is one that requires very thoughtful consideration with a view to reform."—*The Lancet.*

". . . . plain speaking and hard hitting: but Mr. Cooke is right in what he says. Men go up for examination; they are prepared; they are examined; they are not educated. This is probably due to the cause to which Mr. Cooke attributes it. Too much attention is given to the *science* of the subject--too much because it precludes sufficient attention to the *art*. But the science is only of use as a base for the art. . . . . The education of every medical student is a matter of importance to every individual, medical or otherwise. The public has a right to demand that the best methods shall be used--the profession has a right to demand that its interests and its honourable traditions shall be maintained."—*Medical Magazine.*

" Practical anatomy *was* a discipline of *incalculable value*, for not only was the knowledge acquired *an end in itself*, but the method whereby it was gained was *the most valuable part of the entire medical training*. Anatomy occupied a *unique position* in the curriculum. In all other departments the student had no alternative but to blindly accept the dictum of teacher or text-book. Here he was trained to use his eyes and his hands; here he was educated to translate the impressions made by the objects of his study on his senses into words, this enabling him to check the descriptions in his books, or those taught in the lecture room, by comparing the realities under his hands with the verbal accounts of them given by his teachers: *In the dissecting room every student was an investigator.*"

ALEXANDER MACALISTER.

(*The italics are the Author's.*)

"What is the primary want of the physician or surgeon in regard to Anatomy? Is it not to acquire *visual* and *manual* familiarity with the human frame? Is it not to know, in the sense of almost seeing through, and, as far as needs be, of dextrously handling throughout, the individual man, woman, or child he is ausculating or percussing, or whose unconscious form lies under his knife on the operating table? What is it that will give him practical insight into the actual case before him, quickness in understanding its bearings, fertility of resource in dealing with its requirements? Is it not mainly the trained hand that makes straight for the right osseous projection, the educated finger accustomed to the feel of this structure and of that, the sharp eye familiar with the most insignificant guide-point, and which recognises at once a little bit of an exposed tendon, or a certain small nerve, or a thin muscular plane? What serves transcendental anatomy here?"

(*A Plea for Practical Work in Anatomy.*)

"To the practical mind, Morphology is but a dazzling dream—a lovable form of fantasy, which, alas! distorts the vision and warps the judgment—a fairy tale, which blinds us to the facts of everyday life!"

"To such as are past masters in all that can be learnt in the dissecting-room, such pure science may convey the delights of learning and culture, and may do little or no harm. But the tyro should keep clear of all such fascinating seductions."

(*Allegory, – Notes, p.* 108h.)

PARTS II. AND III.:—SOFT STRUCTURES.

TABLE OF CONTENTS.

PREFACE, Pages XIII - XX. ON THE ART OF DISSECTING, Pages XXI - XXXII. (In Part II. only.)

PART II.
(LIMBS, ABDOMEN, PELVIS.)

UPPER LIMB. Pages 33-60.

Axilla & Front of Arm, 33–40. Front of Forearm & Palm of Hand, 41-48. Parts about Shoulder & Back of Upper Limb, 49–60.

Notes on the Newer Matter. Pages 60a-60d. (On white paper.)

Insertion of Pectoralis Major. Insertion of Deltoid. Flexor Brevis, & Adductor Obliquus Pollicis. First Dorsal or First Thoracic Nerve. Dorsal Digital Nerves to the Fingers and Toes. Capsule of the Shoulder-Joint. Transverse Humeral Ligament. Costo-Coracoid Membrane. Vas Aberrans Humeri. Pseudo-Ganglia.

Explanation of Figures not fully explained in the Text, Pages 60e-60f.

Summary of Practical Points. Pages 60g-60m.

LOWER LIMB. Pages 61-96.

Front & Inner Side of Thigh, 61–68. Front of Leg & Dorsum of Foot, 69-72. Glutea, Region, Back of Thigh, Popliteal Space, 73–80. Back of Leg & Sole of Foot, 81, 88. Muscular Attachments, Articulations, Fasciæ & Synovial Membranes, 89–96.

Notes on the Newer Matter. Pages 96a-96f. (On white paper.)

Adductor Obliquus Hallucis. Adductor Transversus Hallucis. Opponens Minimi Digiti. Capsule of the Hip-Joint: Cervical Reflection; Retinacula. Ilio-Femoral Ligament, and Ischio- and Pectineo-Femoral Bands. Fascia Iliaca. Morphology of the Arteries and Nerves of the Limbs Pseudo-ganglia.

Explanation of Figures not fully explained in the Text, Page 96g.

Summary of Practical Points. Pages 96j-96q.

INGUINAL & FEMORAL HERNIÆ & PERINÆUM. Pages 97-108.

Notes on the Newer Matter. Pages 108a-108p. (On white paper.)

MR. SUTTON'S VIEWS ON THE LIGAMENTS AND FASCIÆ. REGRESSION OF MUSCLES: Deep Fasciæ of the Limbs. Abdominal Aponeuroses. Palmar Fascia. Plantar Fascia. Calcaneo-Cuboid Ligaments. Abductor Ossis Metatarsi Quinti. Interosseous Membrane of the Leg. Coraco-Brachialis & Rotator Humeri Muscles. Epitrochleo-Anconeus.

MIGRATION OF THE MUSCLES: Extensor Brevis Digitorum, Peroneus Tertius, Adductor Magnus, Peroneus Longus, & External Lateral Ligament of the Knee-Joint. Round Ligamen of Hip-Joint. Interarticular Fibro-Cartilages & Crucial Ligaments of Knee-Joint.

LIGAMENTS ARISING FROM THE RETROGRESSION OF OSSEOUS AND CARTILAGINOUS STRUCTURES; BONES ARISING FROM THE OSSIFICATION OF LIGAMENTS: Supra-Condyloid Foramen, Lesser Sacro-Sciatic Ligament. Great Sacro-Sciatic Ligament The Typical Shoulder-Joint. Interarticular Fibro-Cartilages of the Sterno-Clavicular & Acromio-Clavicular Articulations. Rhomboid or Costo-Clavicular Ligament, Subclavius Muscle, Conoid & Trapezoid Ligaments, Gleno-Humeral Ligament, or Ligamentum Teres of the Shoulder-Joint. Interclavicular Ligament. Coraco-Acromial Ligament, and Transverse Ligament of the Scapula.

MR. COOKE'S VIEWS ON THE SURGICAL FASCIÆ. Present views on the Fascia of the Neck, the "Perinæal Ledge," &c.

ABDOMEN. Pages 109-132.

Muscles, 110. Peritoneum, 111-113. Superior & Inferior Mesenteric Arteries & Cœliac Axis, 114 & 115. Stomach, Small & Large Intestines, 116-118. Pancreas, Spleen, Bile Ducts & Liver, 119-123. Portal System, 124. Ascending Venous Trunks, 125. Abdominal Aorta & its Branches, 126-127. Common & External Iliac Arteries, 128-129. Lumbar Plexus, 130-131. Diaphragm, 132.

Notes on the Newer Matter. Pages 132-132pp. (On white paper.)

The New or "Reconstructed" Abdomen: Stomach. Duodenum. Large Intestine. Liver. Pancreas. Portal Vein. Spleen. Kidney. Prof. Birmingham's Researches: Stomach-bed, Stomach-chamber, Body of Pancreas. His's Plaster-of-Paris Models, pp. 132a-bb.

Discussion of the "Reconstructed" Abdomen, pp. 132cc-hh.

Development of the Abdominal Digestive Tract and Peritoneum. Development of the Liver. Development of the Pancreas. Fossa Duodeno-jejunalis. Meckel's Diverticulum, pp. 132hh-oo.

Summary of Practical Points. Pages 132pp-rr.

PELVIS & MALE GENITO-URINARY ORGANS. Pages 133-152.

Pelvic Fascia, 135. Side View of Pelvis, 136. Rectum, Kidney, Bladder, Testicle, etc., Spermatic Cord, Prostate Gland, Urethra, Penis, 137-147. Internal Iliac Artery & Branches, 148-151. Sacral Plexus, 152.

Notes on the Newer Matter. Pages 152a-152l. (On white paper.)

Omega Loop of the Colon, and Rectum. Relations of the Kidneys. The Bladder. "Sacral and Coccygeal Aortæ." Rectal and Uro-genital Triangles, and Abdominal and Perinæal Fasciæ, pp. 152a-g.

Development of the Genito-Urinary Organs, pp. 152g-l.

Explanation of Figures not fully explained in the Text, p. 152l.

FEMALE GENITO-URINARY ORGANS. Pages 152*a*-152*p*. (On toned paper.)

Notes on the Newer Matter. Pages 152*q*, 152*r*.

Pudendum, and Uro-genital space. Urethra: Vagina. The true position of the Uterus. Modern description of the Ovary.

PRACTICAL QUESTIONS ON PART II. Pages 152*s*-152*w*.

APPENDIX. Pages 152*x*-152*z*.

Sterno-clavicular and acromio-clavicular articulations. Pudic nerve.

PART III.

(HEAD & NECK, THORAX.)

HEAD & NECK.

Notes on the Newer Matter. Pages 152k-x. (On white paper.)

Deep Origins of the several Cranial Nerves: Mode of Study recommended. Deep Origins of: Third Nerve, 152l; Fourth and Sixth and Facial Nerves, 152m; Auditory Nerve, 152n; Spinal Accessory, Glosso-pharyngeal and Pneumogastric Nerves, 152o; Hypoglossal Nerve, Fifth Nerve, 152p-t. Criticism: Dissectional Anatomy and Paper Anatomy, 152t-w.

Posterior Triangle, 153-160. Anterior Triangle, 161-172. Face, 173-180. Pterygo-Maxillary Region, 181-188. Sub-Maxillary Region, 189-200. Orbit, 201-212. Pharynx & Soft Palate, Back of Neck, 213-220. Nasal Fossæ & Deep Vessels & Nerves of Neck 221-228.

Notes on the Newer Matter. Pages 228a-j. (On white paper.)

Sömmering's classification of the Cranial Nerves, 228a. Cervical Plexus and Hypoglossal Nerve, 228a-b. Olfactory Nerves, 228c. Optic Nerve, 228d. Ligament of Zinn, Tenon's Capsule, and Orbital Cone of Fat, 228e. Tentorium Cerebelli, Fifth Nerve, Meckel's and Sub-Maxillary Ganglia, 228f. Otic Ganglion, 228g. Pneumogastric and Spinal Accessory Nerves, 152h. The Recurrent Laringeal Nerves; Facial Nerve; Jacobson's and the Petrosal Nerves, 158i.

Explanation of Figures not fully explained in the Text, Pages 228k-n.

Summary of Practical Points. Pages 228p-v.

LARYNX. Pages 228*a*-*l*. (On toned paper.)

Notes on the Newer Matter. Pages 228m-p.

The Smaller Muscles of the Larynx.

THORAX. Pages 229-256.

Innominate Veins & Superior Vena Cava, 230. Internal Mammary Artery, 231. Pericardium & Heart, 232-233. Arch of Aorta, Thoracic Aorta & Branches, 234-237. Pneumogastric & Phrenic Nerves, 238-239. Coronary Vessels, 240. Pulmonary Vessels, Lungs & Pleura, 242-244. Mediastinum, 245. Trachea, Bronchi, Œsophagus, 246-247. Venæ Azygos, 248. Thoracic & Right Lymphatic Ducts, 249. Interior & Structure of Heart, and Cardiac Plexuses, 250-255. Sympathetic Cords & Ganglia, 256.

Notes on the Newer Matter. Pages 256a-v. (On white paper.)

Divisions of the Mediastinum. Superior & Inferior Sterno-Pericardial Ligaments. Transverse Sinus of the Pericardium. Great Oblique Sinus. Marshall's Vestigial Fold, and its Contents.

Evolution of the Heart and Aortic Arches: Normal and Abnormal Structures connected therewith. Variations in Number and Position of the Branches arising from the Arch of the Aorta. The Aorta described Embryologically.

Evolution of the Venous System: The Cardinal Veins, and the Veins derived from them. The Left Superior Vena Cava. The Three Successive Stages of the Portal Circulation.

Interspinous & Intertransverse Ligaments, and Rectus Capitis Posticus Minor. Lateral Occipito-Atloid Ligament & Rectus Lateralis. Intervertebral Discs. Suspensory Occipito-Odontoid Ligament. Odontoid Process of the Axis. Sutton's Anterior and Posterior Conjugal Ligaments of the Ribs. Transverse and Check Ligaments of the Atlo-Axoid and Occipito-Odontoid Artriculations. Anterior Arch of the Atlas.

Explanation of Figures not fully explained in the Text, page 256w.

Summary of Practical Points, pages 256x, 256y.

MUSCLES OF THE BACK, specially of the Fourth and Fifth Layers. Pages 257-276.

NERVE-CENTRES AND THEIR COVERINGS. Pages 277-348.

Surface of Cerebrum, 280-291. Corpus Callosum and Lateral Ventricles, 292-305. Transverse Fissure and Velum Interpositium, 306-309. Third Ventricle, and Optic Thalamus, 310-316. Medulla Oblongata, Cerebellum, Fourth Ventricle; Mesocephalon, 317-332. Coverings of the Brain and Cord, and large Vessels, 332-344. Spinal Cord, 345-348.

Notes on the Newer Matter. Pages 348a-348vv. (On white paper.)

Coverings of the Brain and Cord, 348c-348h. Cerebral Surface, 348i-348r. Interior of Brain, 348s-348x. Minute Vascularisation of Brain, 348y-348bb. Cranio-cerebral Topography, 348cc-348ff. Transverse Sections of Medulla and Mesocephalon, 348hh-348pp. Development of the Brain, 348rr-348uu.

Explanation of Figures not fully explained in the Text, pages 348uu, 384vv.

PRACTICAL QUESTIONS ON PART III. Pages 349, 350.

APPENDIX. Pages 351, 352.

Basilar and Superior Thyroid Arteries. Classification of Joints.

PREFACE TO THE ELEVENTH EDITION.

(SOFT PARTS.)

The whole of the Tablets have now been revised by the Authors in the light of modern views.

They further appear in pictorial garb, through the generosity of numerous friends, among whom, Mr. Pickering Pick, editor of Gray's Anatomy, Professors Christopher Heath, Thane, Schäfer, Symington, Ellis, Alexander Macalister, Cunningham, Birmingham, Windle, Reid, Mr. Luther Holden, Mr. Henry Morris, Mr. Bland Sutton, Mr. William Anderson, Mr. Davies-Colley, Mr. Frederick Treves, Mr. Walsham, Mr. Makins, Mr. Shattock, Mr. Parsons, and, abroad, Professors Gegenbaur, Schwalbe, Heitzmann, Sappey, Testut, and others, who, as well as the respective publishers, have all kindly permitted the use of already existing plates.

In regard to the illustrations, though they be rough, perhaps, there are here brought together for the first time both the inimitable sketches of the arteries and veins which we owe jointly to Henry Gray and to Dr. Vandyke Carter, and those brilliant pictures of the nervous system by which Hirschfeld & Leveillé "placed their country," says Mr. William Anderson, "beyond rivalry in anatomical illustration."

The tabulated character of the work threw considerable difficulties in the way of its being illustrated. The figures could not be placed in the midst of the text. They have had to be grouped on separate pages, of such sizes, and in such positions, as could be made to fit in with available space.

As far as possible, the illustrations have been placed either opposite the corresponding text, or in such positions that, *by raising the intervening pages*, text and illustration can be seen at the same time.

The description of the figures is of the briefest. Where fuller descriptions seemed needed they have been given at the end of the section.

The illustrations may be thought by some to be over-numerous. None have been introduced, except on the score of showing certain things left out in others.

At the end of each section a "Summary of Practical Points" has been introduced, taken from the senior Author's "Aphorisms in Applied Anatomy & Operative Surgery." Corresponding questions are set at the end of each of the two last volumes.

Some of the Tablets of the earlier complete editions have been re-introduced, such as those on the deep muscles of the back, – these illustrated from Bourgery and Jacob, – the female genital organs, &c. Thus the Tablets again cover practically the whole ground of dissectional anatomy.

The brain has been recast, as explained in the preliminary remarks appended to that subject.

Being more than doubled in size, the entire work is now divided into three Parts published separately: – I., The Bones; II., The Limbs, Abdomen, & Pelvis; III., The Thorax, and the Head & Neck.

Facilities have again been provided for the easy division of each volume into segments of a convenient size for carrying in the coat pocket. To this effect, the several groups of subjects, – "Anterior Triangle of the Neck," "Axilla; front of arm," "Orbit," &c., – have each been arranged in what bookbinders call a "section;" and if the volume be opened somewhat forcibly between the *front or title page* of one section, and the *last page* of the preceding section, it will easily be divided at this point by simply cutting the bookbinder's threads or tapes. And each section will be found to constitute a pamphlet, which, folded in two, will bear carrying about without falling to pieces. **The advantages of a small book are thus added to some extent to those of a book of larger size** This arrangement has involved, however, some repetitions and a few omissions, the latter generally unimportant, it is believed, and mostly remedied in the Appendix.

The Authors have written throughout for the medical student intending to become a practitioner.

A distinct principle runs through this Edition of the Tablets, – the dissociation, and separate presentation, on the one hand, of the practical, or "dissectional" anatomy, and, on the other, of the "advanced," or "scientific," – or, as it is now authoritatively called (Christopher Heath) "transcendental" – anatomy recently introduced, – *i.e.*, on the one hand, of the anatomy "that can be seen and handled," and, on the other, of "that which cannot."

The former is presented in the Tablets proper.

The latter, or the newer matter, is presented in the Notes on lighter-coloured paper, – these to be re-written from year to year, as may be required. Here important additions have been made to the abdominal viscera, the cranial nerves, the muscles of the larynx, &c.

The division is found, in the Author's classes, to markedly facilitate both the practical work and the abstract study.

The presentation of the new matter, apart from that which is not new, will have an advantage. It will make it the more evident what the real nature of the new matter is. It will be felt that a large part of this differs fundamentally from plain human anatomy; so much so that the two things will have, it is believed, to part company sooner or later, as has been the case, of late years, with histology and anatomy proper.

Different, not only in degree, but in nature or kind, is the attitude towards the "subject" of the student of to-day, as compared with that of the men of but a few years ago. But recently, the object was to dissect, and see, *everything*. Now we go by the "subject" just so far as the "subject" is, so to speak, the most convenient illustration of itself. The limbs are of easy dissection. So we look at biceps, brachial and femoral arteries; and at the carotids, and so forth. But go further afield. Take the herniæ, take the perinæum, take the deeper parts of the head & neck; take especially the visceral cavities and their contents. Here the dissection becomes more difficult: for it to be satisfactory, work both careful and intelligent is required. Here the "parts" are no longer the most convenient illustration of themselves. So we take to plate and model.* And stomach, liver, pancreas, spleen, kidney, are they not "all wrong" in the dissected "subject?" † Here we learn everything (save the mark!) from the reconstructed cast.

Fatal, in effect, to sound practical work is the influence of the "infinitely little" (Sir Dyce Duckworth), now so largely introduced into our text-books. Embryology and Morphology are clearly "out of it" in regard to dissectional anatomy. Not so, unfortunately, the "infinitely little." The "trivial and exasperating details" (Patteson)‡ are always based on the implied assertion, Dissect, and you will see that it is so. The assertion is dissectionally incorrect in most cases, – incorrect in "knife and forceps anatomy" (Mitchell Banks). The Author will stake on this his authority as a *human dissectional anatomist* of over thirty years' standing.

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* "*Numbers who dissect dwindling to a minimum;*" "*Dissections of the deeper parts seldom done now*" (Leading articles in the *Lancet* for Jan. 20th, 1894, and Feb. 6th, 1897).

"The new school dissects but little. It explains, and tries to get men to 'understand'—that is, to imagine. It is true that things are not so *in principle*. *In principle* the new school insists strongly on practical work of all kind. 'One part dissected with care,' writes Professor Macalister, 'is worth a dozen hurried over.' Indeed, the zeal and personal example of the leaders are admirable. But the field of work is so enormously extended by the superadded 'transcendentalism,' that theory and practice cannot go hand in hand. The highest aspirations notwithstanding, the fact is as above stated. – Letter to *Lancet* for May 27th, 1897.

† See the New or "Reconstructed" Abdomen, pp. 132a-bb. The descriptions in Gray, Ellis, Heath, and Holden – so far as they have not been altered of late years – express the experience of thousands of assiduous dissectors during the most earnest dissecting period we have traversed, the period that produced a Hirschfeld and a Sappey. Are these to be set aside for small innovations coming from a source essentially different from that of simple unbiassed observation?

‡ "There must be something radically wrong in the teaching of anatomy which makes the large majority of students loathe and shirk the tedium of dissecting. Anatomy is not taught as the handmaid of Surgery, but as a separate science bristling with technicalities and overloaded with trivial and exasperating details. Hence it is unwillingly learnt, and readily forgotten. And the vast majority of facts, which are all-important in surgery, are soon engulfed in the wreckage which follows the emancipation of an overburdened memory."—(R. C. Patteson, Surgeon to Meath Hospital.)

It will be seen that the Author contends for the supremacy of simple careful dissection in the dissecting room as the criterion and gauge of excellence in regard to the kind of anatomy to be applied by the medical man to medical and surgical purposes. Dissectional anatomy, he maintains, is to be looked upon as a science in itself, independent of, and superior to, the fascinating nicetics of the scientist. It is the only form of anatomy which serves directly the objects of the medical man. It is also the only form of anatomy which has a history at its back, – and a history of noble self-sacrifice and of worthy service rendered. *Alone, to the Author's mind, it constitutes* ANATOMY *in the professional sense.*

Everyone really familiar with the dissected parts may, it is contended, rely upon success at examinations, – and in after-life, as far as the foundations of medicine and surgery are concerned. **It is the Nemesis of book-work and "cram," the necessary outcome of Specialism, that is condemning to failure the undoubtedly earnest – though misguided – efforts of students and teachers alike.***

But we are losing our guiding principles now.

The educational problems fast coming to the front† required to be argued

---

* "Mr. Pridgin Teale's table of the rise of rejections, taken every fifth year, is as follows :—

1861	...	...	...	...	...	...	...	12·4 per cent.
1866	...	...	...	...	...	...	...	14·5 ,,
1871	...	...	...	...	...	...	...	16·6 ,,
1876	...	...	...	...	...	...	...	22·2 ,,
1881	...	...	...	...	...	...	...	30·0 ,,
1886	...	...	...	...	...	...	...	34·8 ,,
1891	...	...	...	...	...	...	...	39·3 ,,
1895	...	...	...	..	...	...	...	41·9 ,,

"'*The Need for Reform of the Medical Examination System.*'—(Pridgin Teale, F.R.S., Crown Member of the General Medical Council)."

The official returns presented to the Royal College of Surgeons of England for the years 1896 and 1897 show the average of rejections at the second examination to be, for 1896, 42·7, and, for 1897, over 50 per cent. *at each one* of the four quarterly examinations. For those going up in anatomy only, the percentage of rejections was 56·3 1896. At the Fellowship Examination held in May, 1897, the rejections exceeded 70 per cent.

"At least one-third of those who begin their medical studies," says the leading article (Address to Students) in the Students' number of the *Medical Times and Hospital Gazette* for the present year, "retire from the field before they have fulfilled their course." It is within the Author's distinct observation that the proportion of the complete and irrevocable failures at the stage of Anatomy and Physiology is now vastly on the increase.

"We are brought face to with a real and growing difficulty, and must come to a deadlock, unless some satisfactory measure of reform in our method of education be devised."—(Macalister.)

* *Re* "Dissectional Anatomy & Paper Anatomy," re Deep Origins of the Cranial Nerves.

"Men leave more and more everything that ties them in any way. Why should they be troubled with superfluous that cannot help them? They can best get up the book-work

with facts in hand, – *over the "parts"* as regards anatomy, and as occasion might present, here a little and there a little.

Hence the interposition of contentional matter throughout the Tablets, which may occasionally be vexatious, it is feared, to those merely wishing to "read up" their anatomy in the shortest time.

Leave is asked to present the Tablets, not only in the light of an anatomical treatise, but also in that of an **Educational Thesis** based on the facts brought out in the study of anatomy.

Viewed from this standpoint, the various contentions, disputations, criticisms, or whatever they may be termed, which are interspersed throughout the work, will appear less out of place than they otherwise might be thought.

There are *two books here*, – a **Treatise**, and a **Thesis.**

Should "the tares" (?) have been gathered?
With them might have been plucked some good ears of corn.
They are left – with apologies – **in the Thesis.***

The book has been lightened, however, in the connection here discussed: "Specialism in Medical Teaching and Examining," "Conditions leading to Success at

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in their own way. And they thus get up the book-work, supporting it on the slenderest substructure of practical knowledge which will just prop it up for a time, – the 'crammer' cleverly binding together the 'scaffolding of words,' – till the examination is past, – when the whole thing is cleared away, like the bunting of holiday rejoicings. Rejoicings, now that the student has past, that he will have nothing more to do with anatomy and physiology!"

"Pity on the poor patients!"

"But, if the student has not past, the 'house of cards,' &c.

"We may be training a school of more or less scientific anatomists, but we are not insisting," writes the *Lancet*, "on such a curriculum of study, and on such examinations, as will produce in the future well-grounded, thoroughly practical, and efficient medical men. Human anatomy must be studied from the human standpoint. . . . Those scientific anatomists who concern themselves with other vertebrates, and who, apparently, treat of an ideal evolutionised human body of their own creation, have no experience of the requirements of those who are destined to medical practice."– (*Lancet*, from January 20, 1894.)

* The Thesis is necessarily interlinked with the new matter, and thus fragmentarily scattered amidst the Notes on the lighter coloured paper.

Examinations and in After-Life," "Advice to Students," – originally written as part of the Preface – have been taken from the book itself, and placed, loose, at the end of Part II., under the cover.

Let it not be gathered that the Author is in any way opposed to "advanced" anatomy. But he does maintain that such Anatomy* should be brought in in the right place, – that is, *after* plain human dissectional anatomy has been well mastered, and then without any misunderstanding as to its subordinate rank in regard to professional purposes.

A word of explanation is required as to the figures.

The proper use of plates and diagrams is for the purpose of identification of the several structures by the beginner, and for saving time in regard to book-work at home, and thus allowing *more time* for *practical work*. It is hoped that the figures of this Edition will be so used. Except for the purposes of revision of work already well done, figures should not be the objects of separate study.

The senior Author is alone responsible for all contentional matter; in regard to such matter, he has frequently been designated simply "the Author."

The considerable delays are apologised for, which have occurred in the publication of this Edition. They have been mainly due to the serious character of large portions of the "Thesis" which runs through it, – as above explained. The Author has desired to carefully weigh, – and to submit to competent critics, – the grave conclusions he has been compelled to adopt in many weighty matters.

That he has been intensely earnest will, he thinks, be apparent.

He maintains that, through circumstances amenable to improvement, men are far less equipped now-a-days for the work that is before them than they formerly were.

An honest effort has been made to establish this on the basis of Anatomy, and to suggest the remedy.

* Does the term *Anatomy* properly apply?

EXTRACTS FROM PREFACE TO THE TENTH EDITION.

There is such a thing as damaging a book in re-editing it.

It is refreshing, in this connection, to read, in the preface to the last Edition of Gray's "Anatomy," that the work "is intended for students of surgery rather than for the scientific anatomist," and that "it is practical rather than abstract and theoretical." In thus taking the lead in the long-looked-for return to what, in the Author's opinion, Anatomy should be, the Editor of Gray is again doing good public service. Is it looking for too much, – it may perhaps be asked, – to hope that certain small additions made here and there to this noble book, under the influence, undoubtedly, of recently prevailing views, may, to use the words of a great teacher, be put back ere long in "their proper place of unimportance," – that is, removed from future issues? As was well said in a recent article in the *Lancet*, anatomical descriptions properly represent averages. Is it not then misleading, – indeed, calculated to defeat the practical purpose aimed at, – to include among the branches of arteries and veins certain insignificant offshoots occasionally found, or said to be found, by some exhaustive writer or other?

It is submitted that *embryological studies tend to such additions*. The examination of the various vanishing parts of the embryo, and the occasional persistence of *certain* of these, – (as in the case of the *vas aberrans humeri* explaining the high division of the brachial artery, and its exceptional relation to the median nerve, and of the *vas aberrans aortæ* explaining the origin of the right subclavian artery as a fourth branch of the aortic arch) – lend a misleading interest to other, quite exceptional, cases of a similar type, – an interest, indeed, proportionate to their very rarity, – that is to say, fictitious. It is not practical forethought, – much as this is pleaded, – which is here brought into play, but the mere "collectioneering" instinct. It is earnestly submitted that the extended study of "varieties" is a source of *weakness, not of strength*, to the practising surgeon. The same may be said of the morphological work now pressed far too much to the front for *practical* purposes.

Microscopical Embryology.—The portion of the science of development which mainly throws light upon, and may therefore be considered, in a way, the basis of, advanced Anatomy, is that which refers to the larger processes of evolution connected with the throwing into shape of the various permanent structures. Neither do

the membranes come in in this connection, which form, so to speak, the common environment of fœtal life, nor does the minute anatomy of any part of the embryo. Such processes as may be followed either with the naked eye, or with relatively low powers, and may therefore be grouped together under the above heading, are alone introduced into this Edition of the Tablets.

The macroscopical outlines submitted may not be without some advantages, which fuller descriptions would not present. They may better disengage the leading points, and thus allow the reader to follow more easily what one may perhaps call the thread of the subject. When once main lines are well grasped, details are easily filled in.

ON THE ART OF DISSECTING.*

"Dissect well and quickly."
"Dissecting should be a fascinating pursuit."

§ 1.

"*De fil en aiguille*"—"From thread to needle"—is a Continental proverbial expression descriptive of a good way to avoid losing small objects, and to easily find them again when they get out of sight. "Keep a thread in the eye of your needle;" and, if you lose sight of the needle, the thread, which you may rely upon seeing, will at any time lead you up to it.

I was working at anatomy in Paris some thirty years ago. "Subjects" were abundant, and we used to dissect the same parts over and over again. It struck me one day, when dissecting the pterygo-maxillary region, that an unnecessary amount of labour was spent on each occasion by the method then, and still at present, in vogue, except at the school of anatomy, – of

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* EXTRACTS FROM PREFACE TO THE DISSECTION-GUIDES:—

The methods here submitted are based upon a careful study of the several parts of the human body *from the dissector's point of view*. They have been slowly elaborated by daily dissections extending over many long years.

They aim at enabling the dissector to make the best and most lasting use of each part he dissects. It will be noticed that the dissections are so planned as to allow the dissector to get down to the bones and ligaments *without removing the superficial structures*, – all structures, both superficial and deep, being thus preserved for after-study.

In physiology, we have been benefiting greatly for now some twenty years by the extension of practical work initiated by the authors of the "Handbook of the Physiological Laboratory."

No corresponding progress has, however, been made in anatomy. Admirable as are the works of Ellis, Heath, and Holden, they cannot be considered to correspond, in

getting out the facial nerve and its branches as they traverse the parotid gland. Not feeling satisfied to proceed without each time cleaning the facial nerve, nor caring to be so long over this preliminary part of the work, I set about looking for a quicker way. I soon found that I could cut down upon the trunk of the facial nerve without much difficulty where it crosses the root of the styloid process, a little above and in front of the prominent transverse process of the atlas, and that, when once on the trunk of the nerve, I could trace out the branches to the face and neck in a very short time. It is in this way that I have dissected the facial nerve ever since, and many are the anatomists that I have surprised by the rapidity and completeness of detail with which the dissection is conducted. Here the transverse process of the atlas leads me to the styloid process, the styloid process leads me to the trunk of the facial nerve, and the trunk leads me to the branches.—"*De fil en aiguille.*"

I would direct attention to the sole of the foot. Have we not all seen, with a kindly pity for him, a poor unfortunate dissector first remove the skin of the sole of the foot as scrupulously as one might remove that over the perinæum or the parts concerned in inguinal or femoral hernia, and then look, in the dense, granular fat, for the plantar cutaneous nerve, and, after failing to find it - as he almost necessarily would – spend some hours more looking, also fruitlessly perhaps, for the digital nerves?* How can we best help the deserving fellow? First, we should tell him that the plantar cutaneous nerve should be looked for where it leaves the trunk of

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anatomy, to, in physiology, the "Handbook." They combine two things, – descriptions of the structures exposed, and rules for exposing them, – the latter being necessarily brief, and more or less overshadowed by the more voluminous descriptive element.

The immediate object of the present opuscule is to dissociate the two elements hitherto combined, with a view to giving the dissector that help which he requires in the dissecting-room more fully than has hitherto been done, – as fully, indeed, it is hoped, as may be consistent with individual effort on the part of the learner.

The kind of anatomy aimed at in these pages, – and, indeed, though less visibly so, in the Author's other publications, – is that thorough practical acquaintance with the human body, which is comparable to everyone's knowledge of the locality in which he lives, – comparable, indeed, to the young gutter urchin's knowledge of the yards, alleys, lamp-posts, door-steps, knockers, and key-holes of the narrow precincts in which his lot is cast, – to whom the very paving stones are familiar, which he treads with his naked feet.

Knowledge of this kind is only to be obtained by careful and repeated dissections.

* See foot-note on page 3.

the posterior tibial, and then be traced down from the leg to the foot. Then we should show him how to find the digital nerves by cutting down upon the plantar fascia and exposing the slips to the toes. This is done by first cutting down upon the back part of the under surface of the os calcis, to which the fascia is attached, and which marks the level at which the fascia is found. The dissector can now, in a few strokes, clean the whole of the fascia forwards till, in the vicinity of the metatarso-phalangeal articulations, it is seen to split up into the above-mentioned slips to the toes. Between these slips, and corresponding to the intervals between the toes, the fat changes character. From being dense, hard, and granular, it suddenly becomes quite soft; and, from being previously bound down by the pressure of the undissected fascia, it comes, as soon as this is removed, to project in, so to speak, four soft pads or cushions. It is beneath these latter that the dividing trunks of the digital nerves are found, which, with the digital

But for repeated dissections to be possible in the present congested state of the medical curriculum, the student must learn to dissect both efficiently and without loss, – *i.e.*, unnecessary expenditure, of time; – he must learn to dissect well and quickly.

The Author's endeavour is to teach him to do this.

What is it that makes certain dissections more difficult than others? All will agree, for example, that a leg is harder to dissect than an arm; but why is this?

What is it, speaking generally, that makes a dissection difficult? Is it the small size of the structures prevalent in certain parts of the body? No. Parts – the limbs especially, and more particularly the nerves of the limbs – are as easy, or easier, to dissect in the fœtus than in the adult. Is it the large number of structures crowded together in a small space? No. Average dissections of the head and neck come well up to the standard of the extremities. Is it a question of muscles being easier to dissect than arteries, arteries than veins, veins than nerves, &c.? No. The dissector who has just had a leg given him, does he not usually dissect with great minuteness the small upper branches of the femoral artery and internal saphenous vein, the lymphatics and glands, and even do his best to find the crural branch of the genito-crural nerve* – while he often neglects, later on, the larger branches of the same trunks and of the profunda? Is it that he specially cares for the "parts concerned in inguinal and femoral hernia"? No; it is exceptional for these to be dissected at all satisfactorily.

It is submitted that it is the *more or less complex felting of the structures* that constitutes the difference between the several parts of the body from the dissector's point of view.

* A correction is necessary in 1897:—This, and various other exemplars, illustrate what was frequent but a few years ago, but not now! The dissector here depicted has almost disappeared from among us.

arteries, which lie a little deeper, can now be traced to the toes without hindrance. Here the os calcis has led to the plantar fascia, which, had it been attempted to cut down upon it directly, would probably have been cut through. The undivided part of the fascia has led to the slips to the toes; these have led to the four soft pads or cushions, which, in their turn, have led to the digital nerves and arteries.—"*De fil en aiguille.*"

Again, let us glance at the popliteal space. What a crowd of superficial structures stand here in the way of the deeper ones! Small sciatic nerve and external or short saphenous vein, with the two branches of origin of the external saphenous nerve; then, beneath the fascia, the sural arteries and veins, and the nerves to the heads of the gastrocnemius and plantaris; how they impede the dissection of trunk-artery, vein, and nerves! Can we wonder at the dissector missing the articular arteries?

Is there a way of rendering the dissection, at least relatively, easy?

Dissect wide of the space itself, clean and lift up the inner head of the gastrocnemius on the one hand, and the outer head on the other. Beneath them you will find the inferior internal articular artery running downwards and inwards upon the tibia, and the inferior external articular passing horizontally outwards above the head of the fibula. Deal similarly with the muscles bounding the popliteal space superiorly, the biceps on the one hand, the semi-tendinosus and membranosus on the other; and the superior internal and superior external articular arteries, if they are not seen at once, can at least be felt upon the femur in the midst of the bed of fat in which they lie. Now the trunk-artery, vein, and nerves can be reached from beneath, and cleaned between finger and forceps. Here again, "*de fil en aiguille.*"

Examples could be multiplied almost *ad infinitum*.

The "*De fil en aiguille*" principle is the best guide to the dissector looking for the smaller structures.

It is the best guide for the demonstrator when helping the student out of his difficulties with his "part."

Towards the middle and greater part of the limbs, the structures run more or less parallel to each other, there is no feeling to speak of, and the dissection is relatively easy.

I have always noticed that there are certain stages in the dissection of almost every part of the body, at which the average dissector is stopped by difficulties which he is unable to overcome, unless a little help be given him.

The deep dissection of Scarpa's triangle is a case in point. The dissector has got out fairly the femoral artery and vein and the anterior crural nerve, with the beginnings, but little more than the beginnings, of their principal branches. But now he is uncertain how to proceed. He does not know how to follow out the branches. He tries one, and finds he cannot get on far with it because there is something in the way. He tries another, with the same result. After doing his best for a time, he gives up the effort, and leaves the part unfinished. I am sure that everyone who has spent, if only a few weeks, in a dissecting room, will be familiar with the case here depicted. To give this dissector a fresh start, all that I have usually found necessary is to show him that he must first free and lift up the branches of the anterior crural nerve, in order to get fairly at the external circumflex artery; and then separate the adductor muscles, so as to get upon the profunda artery with its internal circumflex and perforating branches, and upon the obturator nerve and vessels.

The dissection of the upper part of the anterior triangle of the neck (parotid region) is another similar instance. Where the carotid artery and its later branches dip into the parotid gland, the student finds the deeper dissection hampered by the great auricular nerve and external jugular vein, which, with us at least, he is taught to preserve; by Steno's duct, – to him a something *sui generis* which he has a difficulty in identifying; and by the branches of the facial nerve, so beautifully, but so perplexingly depicted in

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We have much the same thing towards the middle of the anterior triangle of the neck, where, however, the leading structures (principal arteries and veins) may more appropriately be said to radiate somewhat from a centre.

But the arrangement is essentially different towards the root of the limbs (axilla, Scarpa's triangle, gluteal region); towards the extremities (palm of the hand, sole of the foot, dorsum of the foot); towards the upper part of the anterior triangle (parotid region); and towards the lower part (root of the neck). Here complex felting prevails; and here it is that the dissection is less easy, or, rather, *more impeded*.

Why is it that "parts" nicely begun, and promising well at first, are, after many delays, so often left unfinished? Is it simply that the dissector tires of his work? There is a deeper reason than that. It is a question of felting. There is necessarily no felting

plates. Here again, after spending much time in vain efforts, the student once more finds himself stopped in his work. It suffices, I have always found, to put him on the trunk of the facial nerve, as already explained, showing him how its radiating branches *cross* the trunk of the carotid and its later branches, so that the nerves can be traced out in the parotid gland without injuring the arteries, to start the dissector once more "on his way rejoicing."

§ 2.

*Double application of the "De fil en aiguille" principle.**—There is no better proof of the soundness of a principle than to find its indications correct and practical, when brought to bear on new ground. Some twenty years' dissecting did it take to lead up to the "*De fil en aiguille*" principle, and some four or five more to work it out in regard to the more prominent parts of the body generally,† – *i.e.*, as to what *every man* should most certainly dissect, – and to justify the motto, in regard at least to this part of the work, "Dissect well and quickly; dissecting should be a fascinating pursuit." It has barely taken a month, under favourable circumstances, to bring within the conquered area those deeper dissections of the cranial nerves and their ganglia, which few men now venture to undertake. Two favourite pupils from Cambridge had been working throughout the summer of 1895 in the Author's dissecting room, and they had dissected the whole body, as generally understood. There remained a month before return to the University was imperative. The thought occurred, Could not these deserving young fellows be at least shown the less recondite of the structures just referred to? Would not the "*De fil en aiguille*" principle prove itself here the same time-saving and work-improving instrument it has shown itself elsewhere? Work was begun in earnest. Methods of dissect-

in the superficial structures, and consequently these are always easy to clean. It is the deeper structures which, in certain regions, are felted. Here it is that the untrained dissector breaks down.

Can dissecting be made easy? and how?

Some will say to the dissector, Cut away the superficial structures when you have seen them, and thus make the deep ones superficial.

The plan is sanctioned by custom.

I rebel against it, nevertheless.

It deprives the student of what should be pre-eminently his own – the accumulated products of his past labour. It is now lawful to keep "parts" from one end of the session

* Added October, 1895. † See "Dissection-Guides."

ing were thought out, – the correct dissection-methods, it is submitted, – as had been done in the case of the pterygo-maxillary region, the orbit, &c. Within a week the two young Cambridge workers had seen, and within a fortnight more one of them had himself dissected, quite alone, the otic and Meckel's ganglia and their communications (including the petrosal nerves), and the chorda tympani *within* the petrous bone.

Here is the explanation presented in a few words. As there are *two tails* to the thread in the needle's eye, either of which would lead to the needle, so in those harder dissections, – *e.g.*, those of the cranial ganglia – there is a possible *double* application of the "*De fil en aiguille*" principle open to the dissector, whose advantages are extremely marked. Though some diligent students still expose, perhaps, the submaxillary & lenticular ganglia and the chorda tympani *outside* the cranium, to most men, – to many teachers, it is believed, – the otic and Meckel's ganglia, the petrosal nerves, and the chorda tympani *within* the petrous bone, are things to be read about, and looked at in plates, not things to be sought for on the "subject." The *double* application of the "*De fil en aiguille*" principle renders these structures *as easy of dissection as, say, the ansa hypoglossi.* This is how. Having before one the superior maxillary nerve, on the one hand, and the great palatine nerve, on the other, who can fail to come upon Meckel's ganglion, or, afterwards, to trace back from it the stout Vidian trunk? Having thoroughly bared the inferior maxillary nerve, – and turned it out of its foramen (opened up by the removal of the outer part of the bone), – who can fail to see the dense and firm otic ganglion on its inner surface? Having this before one, and on the other hand, the first facial bend, who can fail to make out their connecting link, the small petrosal? Between the facial bend

to the other (six months); they should be kept the full time, undamaged, and be studied over and over again. I never sanction the division of any muscle in the upper limb, except the pectorales major and minor, and sometimes the deltoid; and I require that the outer head of the flexor sublimis digitorum be left undetached. In the lower limb, I only allow the division of the glutei maximus and medius, gastrocnemius, and soleus; and I preserve the arch of the latter. Nevertheless, we dissect down to the bones and ligaments.

The plan of removing the superficial structures takes away the dissector's interest in his "part." The intellectual interest to be taken in dissecting lies in so planning the superficial work as to get at the deeper structures to advantage. To be a good dissector, one must be somewhat of a strategist. Practical anatomy is a question of unravelling the feltwork of the human body. The feltwork must not be cut. It is he who understands the mesh, who will dissect both well and quickly. Dissecting should be a fascinating pursuit.

and the Vidian trunk, who can fail to make out the large petrosal nerve, or even to discover the filaments of Jacobson's nerve to either?

What is the bearing of the above? Said the late representative of Scotland on the General Medical Council: "There can be communicated more sound practical instruction in midwifery in one case of labour than the student would pick up haphazard in his attendance on twenty." Venturing to follow suit, though in a different subject, with the eminent Scotch representative, the Author makes bold to assert that, by the methods submitted, – methods by no means artificial, but based simply on a careful examination of the work that all should do, – there can be taught to any earnest man more sound practical Anatomy in six months than, by generally accepted methods, even diligent men usually learn in their two customary winter sessions. It is a mere question of looking systematically for either or, in the harder dissections, both tails of the thread passing through the needle's eye.

Assuredly there is here a fecund principle, which, when once understood and adopted, as understood and adopted it must be sooner or later, will bear fruit to the enlightenment of the profession everywhere, and as long as the plain Anatomy of Man is the basis of the Surgeon's craft.

§ 3.

Every art has its more or less precise rules, which, if excellence is to be attained, must be carefully applied from the very first. I would lay down four cardinal rules for the dissector:—

1. *The dissector should most carefully study his part BEFORE BEGINNING TO DISSECT IT.* He should study it on plates; he should study it in the museums he has access to, – on the model dissections always left out for study in our anatomical school; he should study it on the dissections of others. The contrast cannot be too strongly accentuated between the dissector who earnestly studies his part first and dissects it afterwards, and he who dissects it first and reads about it afterwards. The former, while he is dissecting, knows what to look for; where things are, what they look like, how they run; where he is on safe ground and can cut freely, where he may do damage and must be cautious. He is planning his operations so as to make the most of his opportunity. He is doing work both enjoyable and of the highest possible order. The best descriptions are but imperfect embodiments of scientific truth: our worthy friend is critically examining and checking such as his teachers have placed before him, and he is laying the foundation of that individual acquaintance with things which

lies at the base of all true knowledge. The other dissector, on the contrary, is blindly bungling through his work, laboriously cleaning, perhaps, a muscular artery because it chances to be large, and removing a ganglion with its roots because, being small, it fails to catch his untrained eye. When he sets to read, he finds that many things of interest have been cut away from his part, and that he has himself greatly restricted his opportunity of learning.

2. A point to which the dissector should pay great attention from the very first refers to the cleaning of all arteries, veins, and nerves. These "long organs" (as, in fact, all the organs of the body) lie in a sheath of connective tissue, which is but *slightly adherent* to them. Why this is, will be easily understood. It is a general rule that, wherever there is pressure or friction, there the cellular tissue becomes laminated and free from fat – *i.e.*, aponeurotic or semi-aponeurotic. It is this condensed layer (more or less condensed according to circumstances) that constitutes the sheath of either vein, nerve, or artery. Let the dissector get his knife *within* the sheath, and he will find that it *will easily peel off. By getting, and keeping within the sheath, the dissector will clean things efficiently, neatly, and quickly.* The only necessary precaution is to keep the knife *from* the side of the "long organ," from which any important branch is given off.

Much the same thing may be said of muscles. We do not generally speak of the sheath of a muscle. A muscle is surrounded, nevertheless, by a closely fitting covering of connective tissue, or fascia. If the dissector knows how to set about his work, he can peel this covering off with the greatest ease,* thoroughly baring the contractile fibres. No more important advice can be given to the dissector than that of thoroughly cleaning all muscles as soon as they present in the course of dissection. Muscles should be cleaned from origin to insertion, – and not in front only, but all round, except, of course, where their nerve, or a large artery, enters their substance. Nothing can do more to further good dissections than the habit of cleaning all muscles early and well. Nothing can hamper the dissector more than the neglect of this part of his work. This leads one on to 3.

3. When an artery, vein, or nerve is to be sought in an intermuscular space, this space should first be *opened up as widely as possible, by dissecting close to, and carefully cleaning, the whole length of the boundary muscles.* This preliminary part of the work will bring the dissector upon the "long organs" *to the greatest advantage.* Opportunities for the useful application of this rule are to be found everywhere. It is one of the *very widest application.*

Where an intermuscular space is susceptible of being opened both from the front and from the back, it is well to delay completing the dissection till the space can be so opened:

* Except as regards the cutaneous surface of a very few muscles, such as deltoid, gluteus maximus, the upper part of the trapezius, the first layer of muscles of the sole of the foot.

e.g., dissection of the dorsalis scapulæ artery and circumflex vessels & nerve in the triangular & quadrilateral spaces at the back of the shoulder; of the anterior tibial artery as it pierces the upper part, and of the anterior peroneal artery as it pierces the lower part, of the interosseous membrane of the leg; of the radial artery as it passes from the dorsum to the palm of the hand, first between the two heads of the first dorsal interosseus muscle or abductor indicis, and then between the adductor pollicis and the inner head of the flexor brevis.*

4. *All superficial structures* should be thoroughly cleaned *from end to end*, so as to be *got well out of the way* (but not removed) before the deeper ones are taken. The dissector should dissect in broad even planes, or strata. The dissection should not be deepened over any small area, and left superficial elsewhere. This rule should be more particularly observed in such parts as Scarpa's triangle, the triangles of the neck, the popliteal space, the bend of the elbow.

§ 4.

It cannot be too strongly impressed upon the dissector that a dissection should be worked at steadily every day till it is completed. A dissection once completed, and of which all the structures are well cleaned, will keep nice for months. Not so with a part which is left unfinished. This spoils more rapidly than the inexperienced would easily believe, and it can never again be made attractive.

All structures that are *nearly bared* should be cleaned thoroughly before work is left off for the day. While a thick layer of fat or fascia left over a structure will preserve it for a time from drying, and keep it fresh, a thin layer, especially of laminated cellular tissue not containing much fat, will, on the contrary, dry up with the structure, and become so thoroughly incorporated with it, that it can never properly be removed. Even the plan of moistening the part will not help much in the case of small structures which have once been allowed to dry; besides which, wetting a part washes out the colour of the muscles, and first whitens and then darkens the connective

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* A step further is open, in a few cases, to the thoughtful dissector. Thus in dissecting the pterygo-maxillary region, the inferior maxillary nerve may first be traced from within the cranium through the foramen ovale, and a probe passed through the foramen by the side of the nerve, the search for which will then be greatly facilitated in the later dissection. Similar cases present in the dissection of Meckel's & the otic ganglia

The sheath of the large nerve-trunks, such as the cords of the brachial plexus, whether in the posterior triangle of the neck or in the axilla, is extremely dense and laminated, and must be peeled off in successive strata before the trunk is really bared; the arrangements of the plexus cannot otherwise be made out.

tissues, so that distinctions of structure previously quite plain are effaced.* Parts should be dissected while fresh, if good work is to be done. Dissection is twice as easy then as it is later on.

The Author would mention approximately, as per following list, the time he finds amply sufficient for a man of average ability, – *but properly instructed as to how he should set about his work*, – to dissect thoroughly the several parts of the human body :—

Arm – 24 to 36 hours.
Leg – 48 to 60 hours.
Thorax (thoracic duct & vena azygos included) – 12 hours.
Abdomen & Back : – Muscles, 12 hours ; viscera, &c., down to the crura of the diaphragm, 24 hours.
Pelvis – 16 hours.
Triangles of Neck – 16 hours.
Pterygo-maxillary Region – 12 hours.
Submaxillary Region & Tongue – 6 hours.
Orbit (superficial, middle and deep dissections, preceded by the dissection of the Gasserian ganglion) – 16 hours.
Orbit from outside, with lenticular ganglion – 8 hours.
Muscles of Pharynx (dissected under water and spirit) – 16 hours.
Muscles of Soft Palate – 8 hours.
Larynx – 6 hours.
Sub-occipital Region – 16 hours.
Meckel's Ganglion – 12 hours.
Otic Ganglion – 6 hours.
Muscles of Face – 16 hours.
Inguinal & Femoral Herniæ – 16 hours.
Perinæum – 24 hours.†

The above list may perhaps have the honour of being somewhat closely scanned. "What," writes already a prominent anatomical teacher, a late member of the Board, now a member of the Court, of Examiners, "no more time given to the thoracic viscera, mediastina, &c., than to the muscles of the abdominal wall?" The reply is that it is the time required for ACTUALLY DISSECTING that has been computed in the above

* The remark applies very specially to the infra-hyoid muscles.

† The Author ventures to assert that, under the following conditions, namely, *the parts being carefully studied beforehand and correct methods of dissecting being adhered to*, and with the reservations mentioned, some 300 hours of *actual dissecting*, – (three hours a day for 100 days, say four months), – is sufficient for a man of average ability to clean every muscle, clean and trace out the stem and named branches of every artery, every venous trunk, every nerve (cutaneous branches sufficiently for their distribution to be clearly made out), and to clean every viscus, &c., of the medically and surgically more important parts of the human body ; and that barely half as much again (say six months in all) would allow the list of parts fairly amenable to dissecting-room work to be practically exhausted. The Author would submit, should the above statement surprise the reader coming across it, that he has verified the above computation on many occasions in connection with the men (selected, it is true, as hard workers, and taken in hand but few at a time) whom he has trained from time to time to act as his prosectors. But taking it (which he cannot admit – if sufficient care is given to the practical guidance of the men) that even twice the time named be a more correct average, he would yet press the question, on teachers and men alike, Does it pay, Is it anything like sound policy, to deal with the all-important subject of Anatomy otherwise than by individual dissection, and is any teaching conducted on sound principles, which tends to develop anything but practical work in Anatomy? Personally, the Author finds no difficulty in getting his men – the men above described – to dissect the whole body *three or four*

list, not the time that should be spent in studying the parts *before*, *during*, and *after* dissection. The distinction will be understood. It is submitted in this connection that the usual practice of reading *as one dissects* is a wrong one, and it is insisted (see first rule of the "Art of Dissecting") that the student should learn from previous dissections, &c., all he possibly can about his "part" BEFORE beginning to dissect it. Then, where the Author avers that much time can be saved, – and much better work done, – is in regard to what is "wasted" on the "bad dissections, sad havoc, abominable, &c.," referred to by Mr. Anderson. (See "The Medical Student in Mr. Anderson's 'Art in relation to Anatomy,'" in "Specialism in Medical Teaching and Examining."

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*times over; this being none too often, he thinks, if a man is to become a practical surgeon.** It will, of course, be remarked, and very properly, that present supplies of "subjects" are inadequate for such advantage to apply all round. But the objection does not meet the sound principle that, if certain work is *for the good of the community at large* (as is that which is desirable, and even necessary, for the sound education of medical men), and the matter is properly explained in the right quarters, the necessary supplies for the same *must* be forthcoming. If our aim, as teachers, is to make money – that is, to get as many students as we can, and to put them on what "subjects" we have, whether adequate in number or not – then we shall never get the required "subjects," nor, in the long run, either the students or their fees. If our aim is to do our best for our students, our profession, and the public, and we only take on such a number of students as we can adequately provide for with the "subjects" we have, then we shall, in the long run, get the "subjects" and the students, and a fair reward for our labours. I was much struck, when I began to teach anatomy, with the above doctrine, as inculcated by Sir Henry Pitman. I may add that I took the teaching to heart, and that, personally, I have never regretted doing so.

Reservations above referred to :—

Cutaneous nerves not to be taken beyond the point up to which they can be dissected with a fair amount of ease; the venæ comites of branch arteries to be removed; the communications and the deeper and smaller branches of the glosso-pharyngeal, pneumogastric, and facial nerves (the chorda tympani outside the cranium excepted), and of the sympathetic, not to be specially looked for, except in the longer course of work; (all the branches of distribution of the hypoglossal nerve to be traced out). No unnecessary time to be spent in cleaning the cutaneous surface of the gluteus maximus or the deltoid, &c.

When parts are dissected several times over, as in "prosecting," they can be dissected thoroughly – dissections worth keeping – in about half the time named. The Author's prosectors dissect, to the fullest extent of honest dissecting-room work, the lower limb in from fifteen to twenty hours, and the upper limb in from ten to fifteen hours. For those who have the opportunities, and who know how to use them, rapidity in dissecting is a mere matter of practice. Of the second year's men in the Author's dissecting room (session of 1895), one has dissected the triangles of the neck six times, and another has dissected the arm five times. A young fellow who has been at work for some five months only, has dissected the thorax three times, the abdomen twice, the arm twice, and once (partly, at least) the head and neck. *Will not these men have a marked advantage when they come to occupy their respective positions in the field of practice!* Anatomical subjects being obtained in number sufficient to meet what are real wants, – the wants *of the community*, be it remembered, – what possibilities in regard to practical surgery are there not here opened up? †

In regard to the short time allotted to the viscera, it will be surprising to those not specially experienced in the matter, to what extent, in the hands of those familiar with the topography of the visceral cavities, the soft connective tissue therein found lends itself to the easy separation and cleaning of their contents. While several weeks, – one would like to say months, – may advantageously be spent on the internal organs, – partly previously to, but mainly after their dissection, – their actual dissection need not, it is averred, occupy more than quite a short space of time. On the other hand, there are other structures, such as the muscles of the face, the dissection of which, whatever be the dissector's skill, demands a relatively large amount of labour. Per contra, and notwithstanding received views, the dissection of certain recondite structures, such as the otic or Meckel's ganglia, the petrosal nerves, &c., is a much easier matter than is generally believed.

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* See the evidence given before the Parliamentary Committee which led to the passing of the Anatomy Act, which was to the effect that *three entire "subjects"* ought to be considered *the minimum* that should be allotted to each medical student in the course of his studies.

† See foot-note above.

UPPER LIMB.

I.

AXILLA; FRONT OF ARM.

THE MAMMA.

Rudimentary in the male, small in the female before puberty; increases in size during pregnancy & after delivery. – **Presents:**

POSTERIOR SURFACE, or BASE — Somewhat concave; nearly circular, but slightly elongated from below upwards & outwards. Rests upon pectoralis major & fascia covering it, and extends from 3rd rib to the 6th or 7th, and from side of sternum to axilla.

ANTERIOR SURFACE — Presents, a little below its middle, the nipple surrounded by the areola.

Nipple – Cylindrical or conical; presents at its apex the openings of the lactiferous ducts. Its surface is of a pink or brownish hue, wrinkled, provided with papillæ, and, near its base, with some sebaceous glands. It is susceptible of a sort of erection due mainly to the contraction of its muscular fibres.

Areola – Rosy in the virgin; larger & darker in colour after the second month of pregnancy & during lactation (when its sebaceous glands enlarge considerably), and also somewhat so during the remainder of life.

CUTANEOUS NERVES.

Superficial Descending – Several large branches from 3rd & 4th.
Descend between sterno-mastoid & trapezius, and divide into branches:

STERNAL – Cross origin of sterno-mastoid to integument of front of chest as far as middle line.

CLAVICULAR – Cross clavicle (sometimes one of them perforates the bone) to integument over pectoralis major & deltoid, communicating with cutaneous branches of the superior intercostal nerves.

ACROMIAL – Over acromion & clavicular origin of trapezius to integument of outer & back part of shoulder.

Lateral Cutaneous – Pierce intercostals & serratus magnus midway between vertebræ & sternum, and divide into: –

Anterior Offset – Forwards to integument of side of chest & mamma, and to upper digitations of external oblique.

Posterior Offset – Backwards to integument over latissimus dorsi & scapula.

The posterior offset of the lateral cutaneous branch of the 2nd intercostal nerve, is called the *intercosto-humeral nerve*. It crosses the axilla, joins with lesser internal cutaneous nerve or nerve of Wrisberg & with internal cutaneous branch of musculo-spiral, and pierces deep fascia to integument of upper inner & back part of arm; its size varies inversely with that of the nerve of Wrisberg. There is frequently a second intercosto-humeral nerve derived from the 3rd intercostal.

Anterior Cutaneous – The termination of intercostal trunk. Pierce internal intercostals & pectoralis major by side of sternum, and turn outwards to integument of mamma & front of chest. The second joins with the clavicular branches of the superficial cervical plexus.

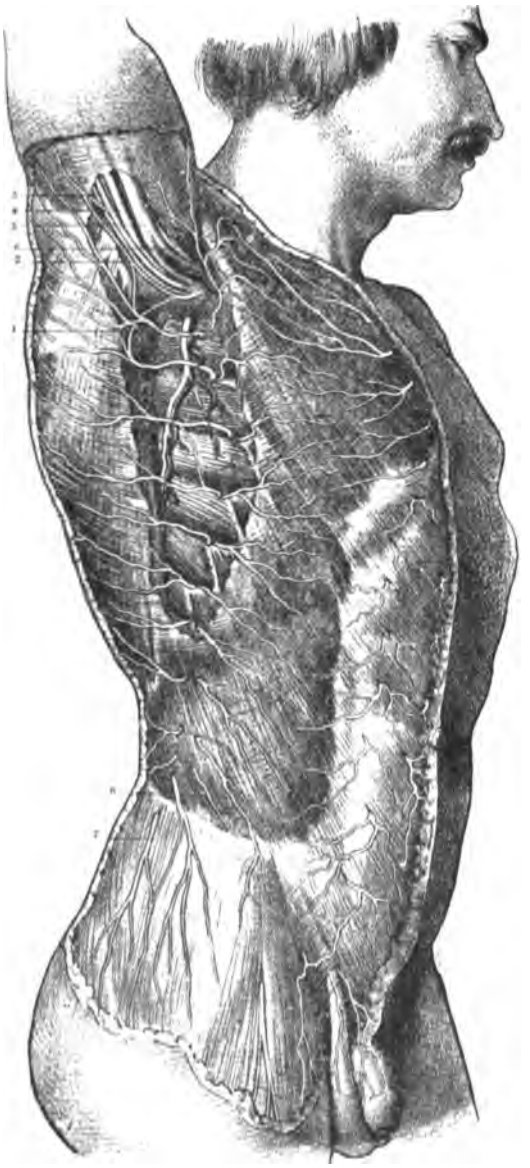


FIG. 176. THE ANTERIOR AND LATERAL CUTANEOUS BRANCHES OF THE INTERCOSTAL NERVES. (Hirschfeld.)

The latter are seen giving off their anterior and posterior offsets. 1, intercosto-humeral nerve, joining with 2, the lesser internal cutaneous; 3, 4, 5, 6, internal cutaneous, ulnar, median, and musculo-cutaneous nerves; 7, iliac branch of the ilio-hypogastric nerve; 8, lateral cutaneous branch of the 12th dorsal nerve.

For superficial descending branches of cervical plexus see Fig. 177.

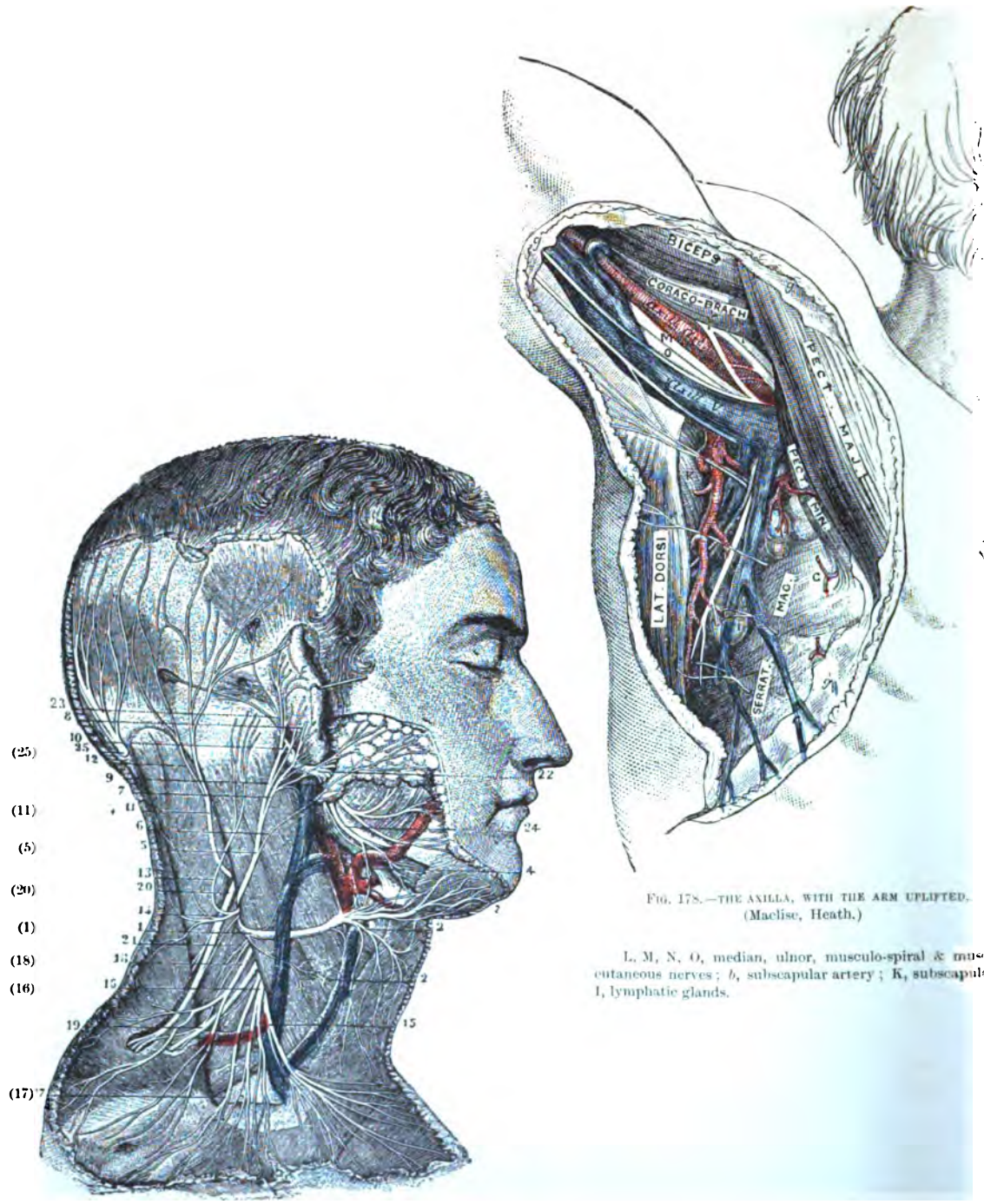


FIG. 177.—THE SUPERFICIAL BRANCHES OF THE CERVICAL PLEXUS. (Sappey, Hirschfeld.)
15, 16, 17, 18, sternal, clavicular, & acromial superficial descending branches.
See further expl., p. 154c—(Part III.)

FIG. 178.—THE AXILLA, WITH THE ARM UPLIFTED. (Maclise, Heath.)

L, M, N, O, median, ulnor, musculo-spiral & musculo-cutaneous nerves; *b*, subscapular artery; K, subscapularis; I, lymphatic glands.

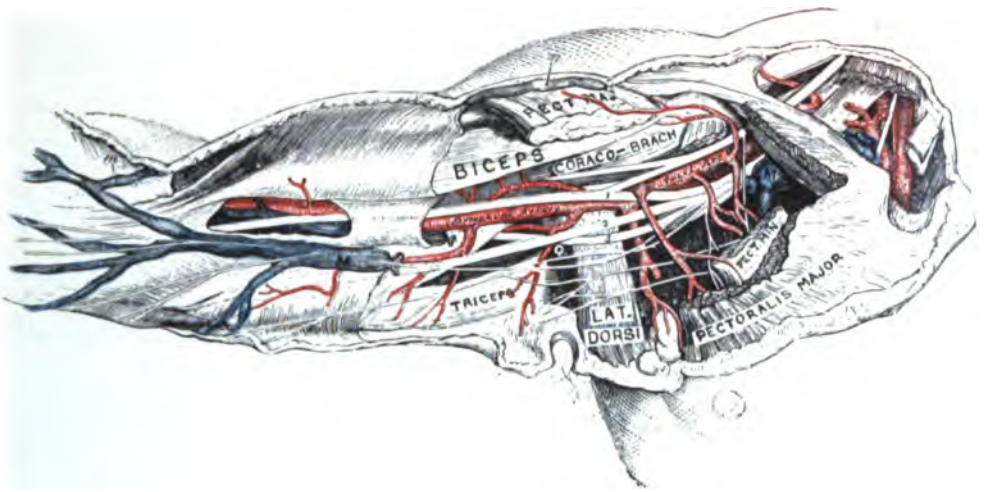


FIG. 179.—THE AXILLA AND UPPER ARM. (Maclise, Heath.)
M, M, basilic vein; *m*, *m*, cephalic vein; 1, 2, 3, median, ulnar, & musculo-spiral nerves; Q, teres major.

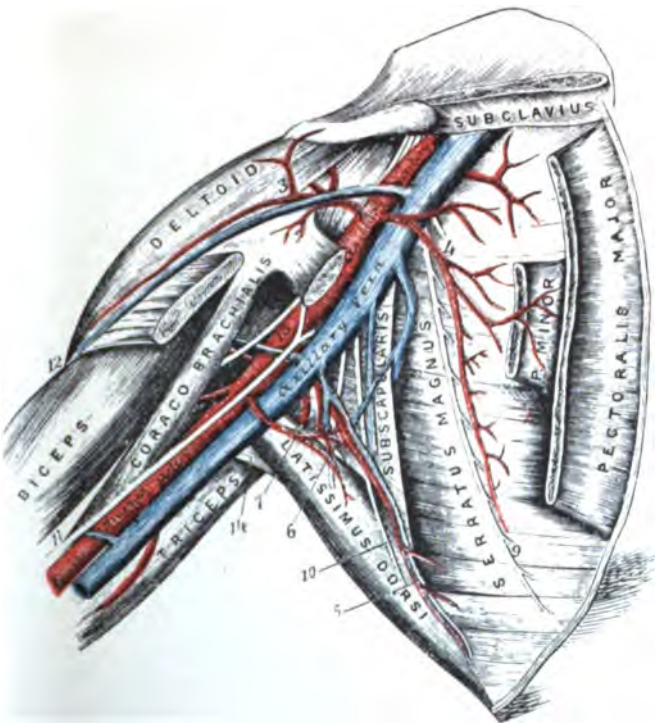


FIG. 180.—THE AXILLA. (Holden.)

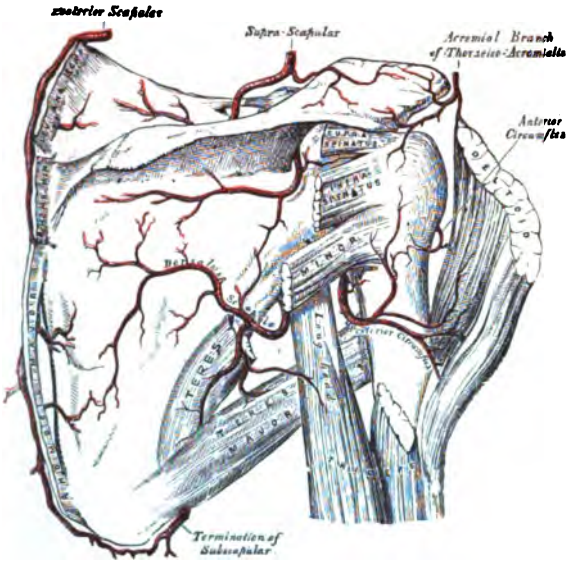


FIG. 181.—THE SCAPULAR AND CIRCUMFLEX ARTERIES. (Gray.)

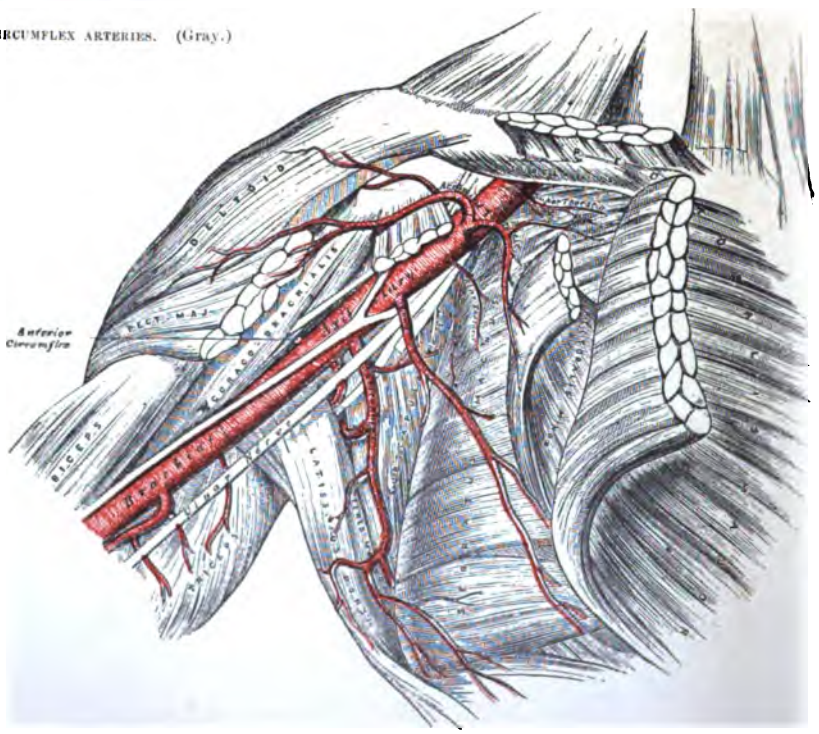


FIG. 182.—THE AXILLARY ARTERY AND ITS BRANCHES. (Gray.)

MUSCLES of UPPER LIMB—1st TABLET.

ANTERIOR THORACIC REGION.

Pectoralis Major – Anterior surface of inner half of clavicle; corresponding half of front of sternum; cartilages of all the true ribs except 1st or 7th or both; aponeurosis of external oblique.

Anterior or outer edge of bicipital groove of humerus. – S. by internal & external anterior thoracic nerves.

Pectoralis Minor – Outer surface & upper border of the 3rd 4th & 5th ribs near their extremities.

Inner border of coracoid process of scapula. – S. by internal anterior thoracic nerve.

Subclavius – Cartilage of first rib in front of rhomboid ligament.

Groove on under surface of middle third of clavicle. – S. by one of the supra-clavicular branches of brachial plexus.

LATERAL THORACIC REGION.

Serratus Magnus – By nine digitations from outer surface & upper border of eight upper ribs (the 2nd rib having two digitations).

Whole length of anterior lip of posterior border of scapula, the two upper digitations being inserted into triangular smooth surface on anterior aspect of superior angle, the three middle digitations into posterior border between superior & inferior angles, and the four lower digitations into anterior aspect of inferior angle. – S. by posterior or long thoracic nerve or external respiratory nerve of Sir C. Bell.

Latissimus Dorsi – Spinous processes of the 6 or 7 lower dorsal vertebræ; by the posterior layer of lumbar aponeurosis, from the lumbar & sacral spines and the back part of outer lip of crest of ilium; from outer lip of crest of ilium for an inch or more in front of lumbar aponeurosis; from the last three or four ribs interdigitating with external oblique; sometimes by a few fibres from inferior angle of scapula.

Bottom of bicipital groove of humerus a little higher up than teres major by a broad flat tendon twisted upon itself. – S. by long subscapular nerve.

Rule for relation of Artery & Vein (in body)

36 Vein & Artery on the same plane – Above diaphragm Vein lies in front – Below diaphragm vein lies behind.

Exceptions
1. Axillary vein at base of Clavicle } above
2. Pulmonary " outside of lung } diaphragm
3. Superior Mesenteric Vein } below
4. Renal } diaphragm
5. Profunda Femoris } diaphragm

4

AXILLARY ARTERY

6 Veins & Corresponding

If vein & artery are not on same plane above diaphragm vein is above artery – below diaphragm artery is above vein

From outer border of first rib to lower border of tendons of teres major & latissimus dorsi, being either straight or slightly curved upwards or downwards according to position of limb, and lying deeply at its origin & superficially at its termination.

May be divided into three parts:

FIRST PART – Above pectoralis minor; rests upon thoracic wall.

SECOND PART – Behind pectoralis minor; passes obliquely from thorax to arm

THIRD PART – Below pectoralis minor; lies on inner side of neck of humerus.

RELATIONS:

FIRST PART:

IN FRONT – Pectoralis major, costo-coracoid membrane; cephalic & acromio-thoracic veins; external anterior thoracic nerve.

BEHIND & ON INNER SIDE – First intercostal space, first digitation of serratus magnus, posterior thoracic nerve.

ON INNER SIDE & IN FRONT – Axillary vein.

ON OUTER SIDE – Brachial plexus.

SECOND PART:

IN FRONT – Pectorales major & minor.

BEHIND – Upper part of subscapularis & posterior cord of brachial plexus.

ON INNER SIDE – Axillary vein & inner cord.

ON OUTER SIDE – Coraco-brachialis & outer cord.

THIRD PART:

IN FRONT – Pectoralis major (except at lowest part), junction of the two heads of median nerve.

BEHIND – Lower part of subscapularis, tendons of teres major & latissimus dorsi, musculo-spiral & circumflex nerves.

ON INNER SIDE – Axillary vein, inner head of median, ulnar, internal cutaneous & lesser internal cutaneous nerves.

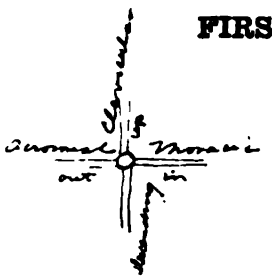
ON OUTER SIDE – Coraco-brachialis, outer head of median nerve, musculo-cutaneous nerve.

Below Axillary & Popliteal arteries there are Venae comites

It is necessary to tie [illegible] posterior to axillary, the 3rd portion [illegible]

BRANCHES of the AXILLARY ARTERY

Vary considerably in mode of origin, size & number. Are still usually described after Haller as being given off as follows, from



FIRST PART:

Sup. Thoracic — Small. Inwards along upper border of pectoralis minor, and then between latter muscle & pectoralis major; anastomoses with intercostales & internal mammary.

Acromio-thoracic — Short, thick, from fore part of artery. Forwards to upper border of pectoralis minor, and divides into branches:

ACROMIAL – Join with suprascapular & with both circumflex.

THORACIC – Two or three. To pectorales & serratus magnus, and join with intercostales & internal mammary.

HUMERAL – One, rather large. Downwards with cephalic vein between pectoralis major & deltoid.

SECOND PART:

Long Thoracic or Ext. Mammary — Large branch. Along lower border of pectoralis minor to mamma, pectorales & serratus, and to axillary glands & subscapularis. Joins with the other thoracic & with subscapular.

Alar Thoracic — Small & often wanting. To axillary glands & cellular tissue.

THIRD PART:

Subscapular — The largest branch. Along lower border of subscapularis to lower angle of scapula, where joins with posterior scapular. Gives off twigs to surrounding muscles, and

DORSALIS SCAPULÆ – Arises an inch & a half from origin of subscapular. Round outer border of scapula between teres major, teres minor & long head of triceps, and then between teres minor & the bone. Gives off;

Branches to subscapular fossa between subscapularis & bone; join with posterior- & suprascapular.

Descending br. between teres major & minor.

Branches to infraspinous fossa; join with posterior- & suprascapular.

Ant. Circumflex — The smaller. Outwards beneath coraco-brachialis, short head of biceps & deltoid, giving off twig to shoulder joint; joins with following & with acromial branch of acromio-thoracic.

Post. Circumflex – The larger. Through quadrangular space between teres major, teres minor, long head of triceps & humerus, and round neck of humerus beneath deltoid. Gives twigs to shoulder joint, and joins with preceding & with acromial branch of acror

BRACHIAL PLEXUS.

Formed as follows by anterior divisions of 5th, 6th, 7th, & 8th cervical and 1st dorsal nn.:
Fifth & Sixth Cervical unite between anterior & middle scaleni, and form the OUTER PRIMARY CORD.
Eighth & First Dorsal unite behind scalenus anticus, and form the INNER PRIMARY CORD.
Seventh forms alone the MIDDLE PRIMARY CORD.
All three primary cords divide into *anterior & posterior divisions.*
Anterior divisions of *outer & middle* primary cords form the OUTER CORD.
Anterior division of *inner* primary cord forms the INNER CORD.
Posterior divisions of *all three* primary cords form the POSTERIOR CORD.

Broad between anterior & middle scaleni, where anterior divisions of the nerves lie above 2nd part of subclavian artery; contracted opposite clavicle, where inner & outer cords lie at fore part of plexus on outer side of 3rd part of subclavian artery & of 1st part of axillary; again expanded in axilla, where the three cords lie on inner, outer & posterior aspects of 2nd part of axillary, and where they break up into the large nerves of upper limb.

Communicates with the cervical plexus through loop between 4th & 5th nerves & through branch from 5th nerve to phrenic, and with middle & inferior ganglia of sympathetic.

BRANCHES — Are

ABOVE THE CLAVICLE:

Post. or Long Thoracic, or Ext. Respiratory of Sir C. Bell – From 5th & 6th nerves, the two roots uniting in substance of scalenus medius.
Deeply along side of chest behind axillary vessels & cords of brachial plexus as far as lowest digitation of serratus magnus.

Suprascapular – From back of trunk formed by union of 5th & 6th.
Backwards & outwards beneath trapezius & through suprascapular foramen to supraspinous fossa, where lies between supraspinatus & the bone.
Round spine of scapula to infraspinous fossa. – Supplies supra- & infraspinati (two twigs to each), shoulder-joint & scapula.

Muscular – To rhomboidei & frequently to levator anguli scapulæ (from 5th nerve), subclavius (from 5th & 6th, anastomoses frequently with phrenic), scaleni & longus colli (variably from 6th 7th & 8th.)

Communicating – From 5th cervical to phrenic on anterior scalenus.

BELOW THE CLAVICLE — The branches are given off from the three cords as follows, from:

Outer Cord – External anterior thoracic, outer head of median, musculo-cutaneous or external cutaneous.
Inner Cord – Internal anterior thoracic, inner head of median, ulnar, internal cutaneous, lesser internal cutaneous or n. of Wrisberg.
Posterior Cord – The three subscapular nerves, musculo-spiral & circumflex

Anterior Thoracic Nerves – Two, connected together by a loop on inner side of axillary artery
EXTERNAL OR SUPERFICIAL – The largest. Crosses both axillary artery & vein to under surface of pectoralis major.
INTERNAL OR DEEP – The smallest. Between artery & vein, and gives twigs to under surface of both pectorales.

Subscapular Nerves – Three:
UPPER – The smallest; to upper part of subscapularis.
LOWER – To lower border of subscapularis & to teres major; the latter muscle having sometimes a separate nerve
LONG – The largest. Along lower border of subscapularis to latissimus dorsi

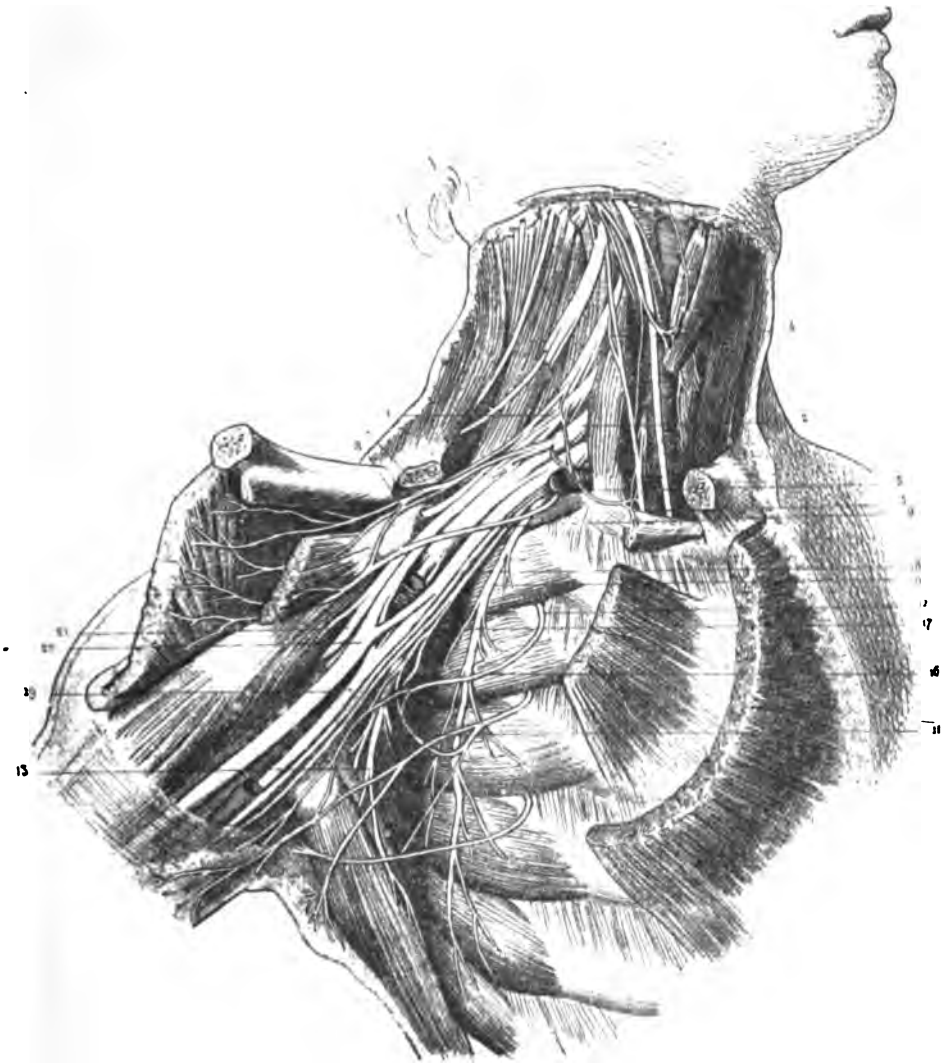


FIG. 183.—BRACHIAL PLEXUS AND NEIGHBOURING NERVES. (Hirschfeld.)

The clavicle has been sawn through near its sternal end, and is turned aside with the muscles attached to it; the subclavius and greater & lesser pectorals have been removed from the front of the axilla.

1, 2, 3) Anterior divisions of 5th, 6th, 7th, and 8th cervical nerves; the anterior division of the first dorsal nerve is seen emerging from behind the subclavian artery, A.

(4) Phrenic nerve, joining with nerve to subclavius.

(6) Posterior or long thoracic nerve;

8, external anterior thoracic nerve, supplying pectoralis major, and joining with internal anterior thoracic nerve, 9, which supplies both pectorales;

5, nerve to subclavius;

7, suprascapular nerve;

11, 12, 13, upper, lower, and long subscapular nerves;

17, lesser internal cutaneous nerve, joining with intercosto-humeral nerve, 16;

18, internal cutaneous nerve.

17, lesser internal cutaneous nerve;

(19) Ulnar nerve.

(20) Median nerve.

(21) Musculo-cutaneous nerve.

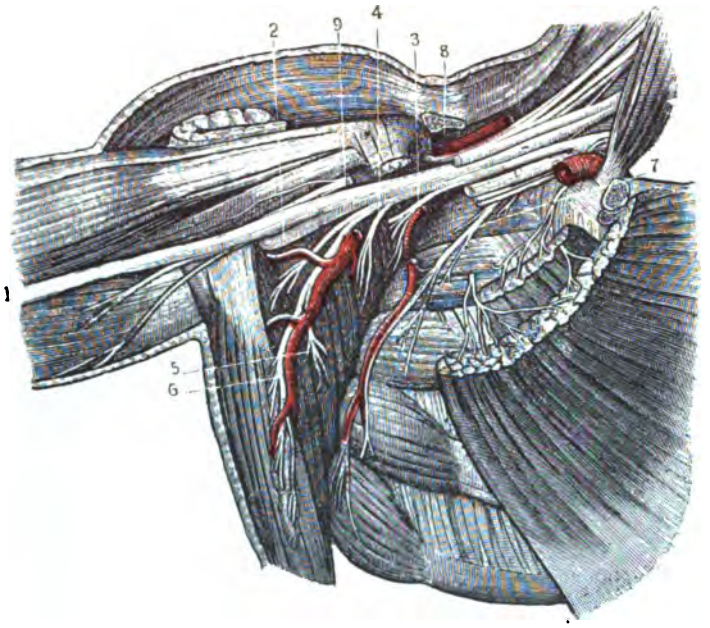


FIG. 184.—DEEP VIEW OF BRACHIAL PLEXUS.
(Cruveilhier, Hirschfeld.)

1, musculo-spiral; 2, circumflex; 7, posterior or long thoracic; 8, suprascapular; 9, musculo-cutaneous; 3 & 4, upper & lower 5, 6, long subscapular nerves.

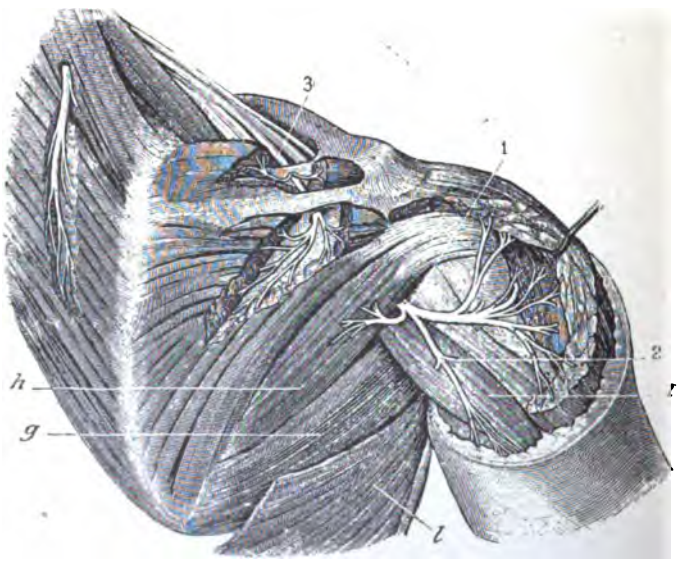
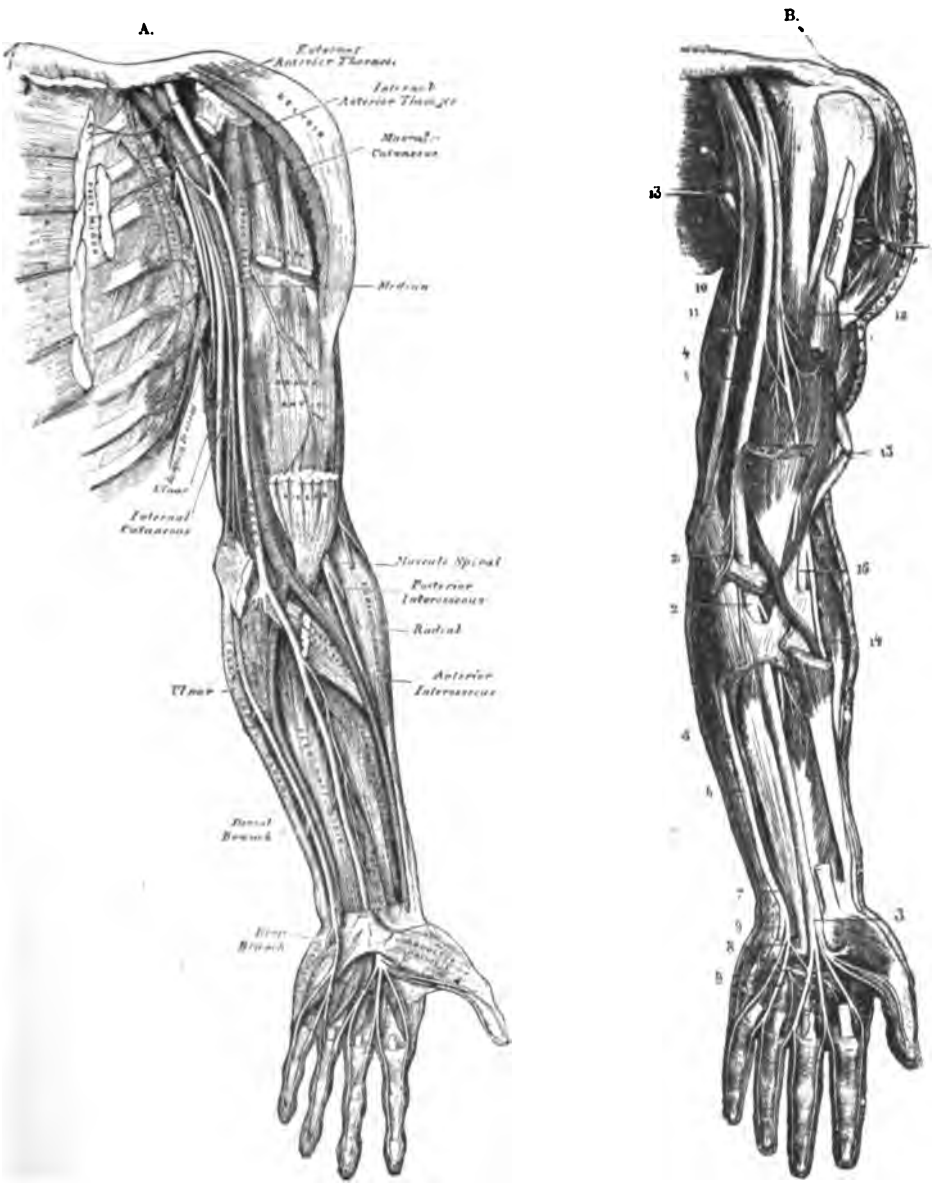


FIG. 185.—CIRCUMFLEX & SUPRASCAPULAR NERVES.
(Cruveilhier, Hirschfeld.)

1, 2, Upper & lower divisions of circumflex nerve; 3, suprascapular nerve; *g*, *h*, teres major & minor; 1, latissimus dorsi; *i*, long head of triceps.



FIGS. 186 & 187.—ARTERIAL TRUNKS AND NERVES OF THE UPPER EXTREMITY : FRONT VIEW. (A, Gray ; B, Hirschfeld.)

(For explanation of B see p. 160e.)

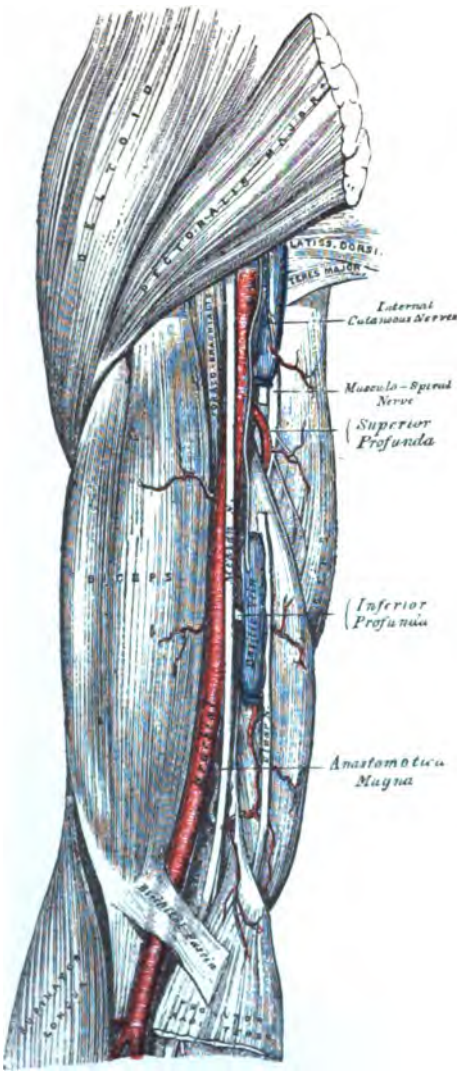


FIG. 188.—THE RIGHT BRACHIAL ARTERY. (Gray.)

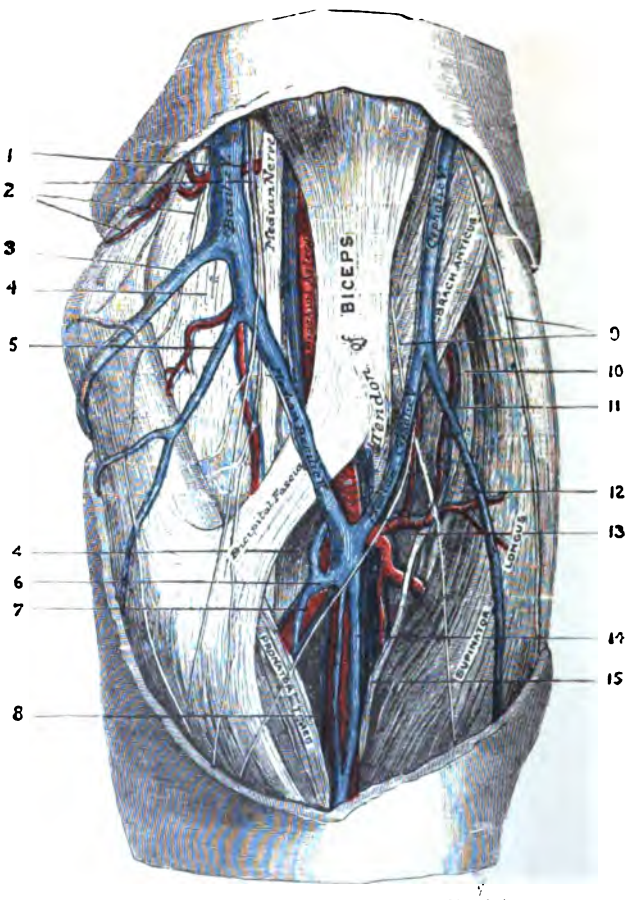


FIG. 189.—THE BEND OF THE LEFT ELBOW. (Morris.)

(See expl., p. 160e.)

MUSCLES of UPPER LIMB—2nd TABLET.

ANTERIOR BRACHIAL REGION.

Biceps:

SHORT HEAD – Tip of coracoid process of scapula in common with coraco-brachialis

LONG HEAD – Top of glenoid cavity of scapula & glenoid ligament.

Back part of bicipital tuberosity of the radius. – S. by musculo-cutaneous nerve.

Coraco-brachialis – Tip of coracoid process of scapula in common with short head of biceps.

Rough impression a little above middle of inner surface of shaft o humerus. – S. by musculo-cutaneous nerve.

Brachialis Anticus – Lower half of inner & outer surfaces of shaft of humerus; front of internal & external intermuscular septa.

Under surface of coronoid process of ulna. – S. by musculo-cuta neous & musculo-spiral nerves.

BRACHIAL ARTERY

Commences at lower border of tendons of teres major & latissimus dorsi.

Down inner & anterior aspects of arm in groove along inner border of coraco-brachialis & biceps, lying at first on inner side, and then in front of, humerus,– its more precise direction being marked by a line drawn from outer side of axilla to midway between condyles of humerus

Divides into radial & ulnar half an inch below bend of elbow, or opposite neck of radius.

RELATIONS:

ALONG THE ARM:

In front – Skin and fascia, inner border of coraco-brachialis & biceps; median nerve.

Behind – Long and inner heads of triceps, superior profunda artery & musculo-spiral nerve; coraco-brachialis, brachialis anticus.

On Inner Side – Skin & fascia, internal cutaneous nerve, basilic vein; ulnar nerve in upper part, median nerve in lower part.

On Outer Side – Coraco-brachialis & biceps, humerus in upper part.

AT BEND OF ELBOW:

In front – Skin, superficial fascia, median basilic vein, branches of anterior division of internal cutaneous nerve; bicipital or semilunar fascia

Behind – Brachialis anticus & elbow joint.

On Inner Side – Pronator radii teres, median nerve.

On Outer Side – Tendon of biceps, supinator longus, musculo-cutaneous & musculo-spiral nerves.

BRANCHES:

Muscular — Irregular, to coraco-brachialis, biceps & brachialis anticus.

Nutritious — From near middle of artery. Enters nutrient canal near insertion of coraco-brachialis, and descends towards lower extremity of the bone.

Sup. Profunda — From upper part of artery. With musculo-spiral nerve in groove of same name between inner & outer heads of triceps, and then between supinator longus & brachialis anticus, where joins with radial recurrent. Gives off muscular branches, and an articular branch to back of elbow joint, which joins with interosseous & posterior ulnar recurrent, and with inferior profunda or anastomotica magna.

If Sup. Profunda Brachiae alone Sup. Profunda only collateral Circulation for Supply of Arm is Anastomosis between Subscapular & Sup. profunda

Inf. Profunda — Small, from near middle of artery. With ulnar nerve through internal intermuscular septum, and then between inner condyle & olecranon; anastomoses with posterior ulnar recurrent & anastomotica magna.

Anastomotica Magna — From lower part. Through internal intermuscular septum, and round back of humerus forming an arch above olecranon fossa with articular branch of superior profunda. Joins with anterior & posterior ulnar recurrent & with inferior profunda

UPPER LIMB.

II.

FRONT OF FOREARM.
PALM OF HAND.

SUPERFICIAL VEINS.

Radial – Commences at outer side of arch on dorsum of hand. Receives branches from back of thumb & index finger, ascends along front of outer side of fore-arm, communicating with median, and joins at bend of elbow with median cephalic to form the cephalic.

Anterior Ulnar – Commences on anterior aspect of wrist & inner side of palm of hand, ascends along front of inner side of fore-arm communicating with posterior ulnar & median, and, at bend of elbow, joins with posterior ulnar, & then with median basilic, to form the basilic.

Posterior Ulnar – Commences at inner side of arch on dorsum of hand, receiving vena salvatella from little finger, ascends along back of inner side of forearm, and, at bend of elbow, joins with anterior ulnar, & then with median basilic, to form the basilic.

Median – Commences in superficial structures of palm of hand, ascends along middle of front of fore-arm communicating with radial & anterior ulnar, and, after receiving a large branch from venæ comites of brachial, divides at bend of elbow into median cephalic & median basilic.

Median Cephalic – Usually the smaller. Ascends in groove between biceps & supinator longus, lying mainly in front of branches of anterior division of external cutaneous nerve, and joins with radial vein to form the cephalic.

Median Basilic – Usually the larger. Ascends in groove between biceps & pronator radii teres, being more or less surrounded by branches of anterior division of internal cutaneous nerve, and lying in front of brachial artery, from which it is separated by bicipital or semilunar fascia.

Cephalic – Somewhat smaller than basilic. Ascends in groove along outer border of biceps and then in interspace between pectoralis major & deltoid, in which latter situation it is accompanied by humeral or descending branch of acromio-thoracic artery, and ends in axillary vein between coracoid process & clavicle, its opening being guarded by a pair of valves. It communicates sometimes with external jugular or subclavian by a small branch which ascends in front of clavicle.

Basilic – Somewhat larger than cephalic. Ascends in groove along inner border of biceps, pierces deep fascia with internal cutaneous nerve a little below middle of arm, and ends in one of the brachial veins or in the axillary.

N.—Numerous varieties are observed in the disposition of the veins of the bend of the elbow; the median vein with both its terminal branches may be entirely wanting, or, the vein itself being wanting, its two terminal branches may be supplied either by the radial or the anterior ulnar.

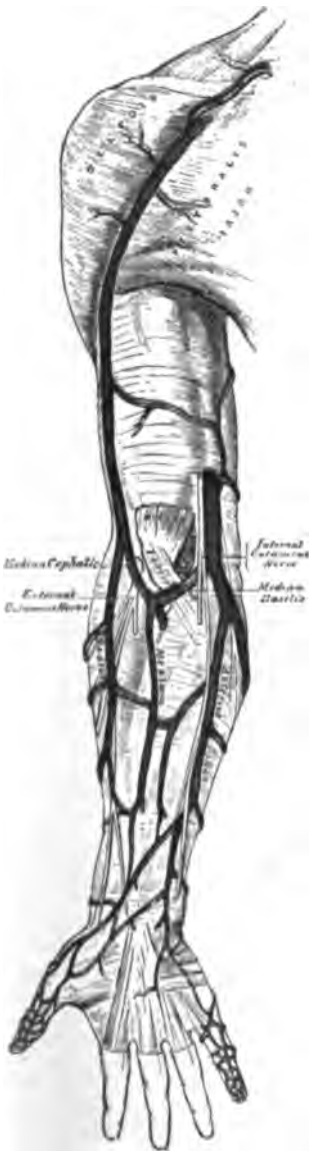
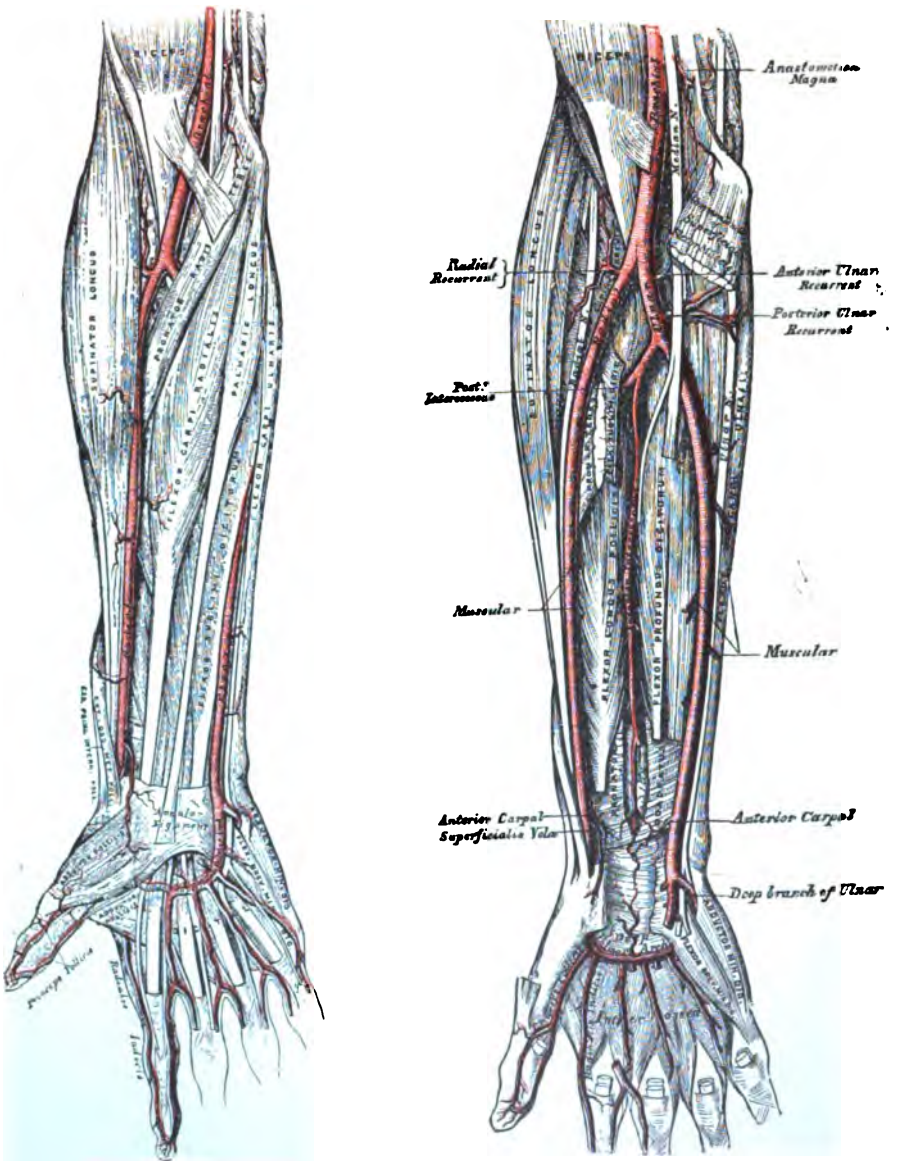


FIG. 190.– THE SUPERFICIAL VEINS OF THE UPPER EXTREMITY. (Gray.)

FIGS. 191, 192, 193.– MUSCLES OF THE FRONT OF THE FOREARM. (Massie.)



FIGS. 194 & 195.—THE RADIAL AND ULNAR ARTERIES. (Gray.)

MUSCLES of FRONT of FOREARM.

SUPERFICIAL LAYER.

Pronator Radii Teres.

LARGE OR SUPERFICIAL HEAD – Inner condyle & inner border of humerus immediately above it, deep fascia of forearm, intermuscular septum between it & flexor carpi radialis.

SMALL OR DEEP HEAD – Ridge on inner surface of coronoid process of ulna below flexor sublimis digitorum.

Rough impression on middle of outer surface of shaft of radius. – S. by median nerve.

Flexor Carpi Radialis – Inner condyle by common tendon; deep fascia; intermuscular septa on either side.

Front of base of 2nd metacarpal bone, & slightly into that of 3rd. – S. by median nerve.

Palmaris Longus – Inner condyle by common tendon; deep fascia; intermuscular septa on either side.

Anterior annular ligament of carpus and palmar fascia. – S. by median nerve.

Flexor Carpi Ulnaris.

ANTERIOR OR INNER HEAD – Inner condyle by common tendon; deep fascia; intermuscular septum between it & palmaris longus.

POSTERIOR OR OUTER HEAD – Inner border of olecranon, and by an aponeurosis which is common to it & to the flexor profundus, from upper two-thirds of posterior border of shaft of ulna.

Pisiform bone and slightly into annular ligament & base of 5th metacarpal bone. – S. by ulnar nerve.

Flexor Sublimis Digitorum.

INNER HEAD – Inner condyle by common tendon, and internal lateral ligament of elbow-joint.

MIDDLE HEAD – Tubercle on inner surface of coronoid process of ulna above pronator radii teres.

OUTER HEAD – Oblique line on front of radius.

Sides of second phalanges. – S. by median nerve.

DEEP LAYER:

Flexor Profundus Digitorum – Depression on inner side of coronoid process of ulna, upper two-thirds of anterior & inner surfaces, and, by an aponeurosis which is common to it & to flexor carpi ulnaris, from upper two-thirds of posterior border of shaft of ulna; inner half of interosseous membrane.

Bases of third phalanges. – S. partly by ulnar nerve, partly by anterior interosseous branch of median nerve.

Flexor Longus Pollicis – Upper two-thirds of anterior surface of shaft of radius; outer half of interosseous membrane; occasionally by a small slip from inner side of coronoid process.

Base of last phalanx of thumb. – S. by anterior interosseous branch of median nerve.

Pronator Quadratus – Lower fourth of anterior surface & inner border of ulna; aponeurosis which covers inner third of the muscle.

Lower fourth of anterior surface & outer border of radius. – S. by anterior interosseous branch of median nerve

MUSCLES of OUTER SIDE of FOREARM.

Supinator Longus – Upper two-thirds of external condyloid ridge of humerus, external intermuscular septum.

Outer side of base of styloid process of radius. – S. by musculo-spiral n.

Extensor Carpi Radialis Longior – Lower third of external condyloid ridge of humerus, external intermuscular septum.

Back of base of second metacarpal bone. – S. by musculo-spiral nerve.

Extensor Carpi Radialis Brevior – External condyle of humerus by a tendon common to it & to superficial muscles of back of forearm; external lateral ligament of elbow-joint; deep fascia; intermuscular septa on either side.

Back of base of third metacarpal bone. – S. by posterior inter

RADIAL ARTERY

The smaller branch of bifurcation of brachial half an inch below bend of elbow or opposite neck of radius.
Down front of outer side of forearm to a little to inner side of styloid process of radius.
Round outer side of carpus beneath extensor tendons of thumb.
Through upper part of first interosseous space between the two heads of abductor indicis.
Over bases of metacarpal bones & interossei, and beneath flexor tendons, lumbricales & nerves to base of 5th metacarpal bone, where inosculates with communicating branch of ulnar, forming deep palmar arch. Lies a finger's breadth above level of superficial palmar arch.

RELATIONS in FOREARM:

In Front – Skin, superficial fascia, deep fascia, supinator longus.
Behind – Tendon of biceps, supinator brevis, pronator radii teres, flexor sublimis digitorum, flexor longus pollicis, pronator quadratus, lower end of radius.
On Outer Side – Supinator longus, radial nerve in middle third.
On Inner Side – Pronator radii teres, flexor carpi radialis.

BRANCHES:

IN FOREARM:

Radial recurrent — From upper part. Between brachialis anticus & supinator longus, and anastomoses with interosseous recurrent & superior profunda.

Muscular — Numerous, to muscles on either side.

Ant. carpal — From lower part. Joins with anterior carpal branch of ulnar beneath deep flexor tendons; gives twigs to articulations of carpus.

Superficialis volæ — From termination of artery in forearm. Small, and ends in muscles of thumb; or of more considerable size, and joins with & completes superficial palmar arch.

ON BACK OF WRIST:

Post. carpal — Over back of carpus beneath extensor tendons. Joins with posterior carpal branch of ulnar to form posterior carpal arch, which anastomoses with termination of anterior interosseous artery of forearm, and gives off:

Dorsal Interosseous Arteries of Third & Fourth Spaces – Anastomose at upper part of interosseous spaces with perforating branches of deep palmar arch. – Are usually exhausted in sheaths of tendons, interossei & integument over back of first phalanges, but are sometimes larger than usual, and are then prolonged upon dorsum of fingers in the shape of dorsal digital branches similar to those of thumb & outer side of index, and of toes.

Metacarpal, or Dorsal Interosseous Art. of Second Space — Arises beneath extensor tendons of thumb, sometimes in common with posterior carpal, and is similar to, but larger than, the foregoing interosseous arteries.

Dorsales pollicis / **Dorsalis indicis** — Correspond together to a first dorsal interosseous artery. The former supplies dorsal digital branches to both sides of back of thumb, the latter forms the dorsal digital branch of outer side of back of index.

IN PALM OF HAND:

Princeps pollicis / **Radialis indicis** — Correspond together to a first palmar interosseous artery. The former supplies palmar digital branches to both sides of front of thumb, the latter forms the palmar digital branch of outer side of front of index.

Perforating — Three. Through upper part of three inner interosseous spaces, and anastomose with corresponding dorsal interosseous arteries.

Deep palmar interosseous — Usually three or four, but very variable in size & number. Descend in front of interosseous spaces, join with superficial palmar interosseous branches from superficial palmar arch, and then bifurcate to form palmar digital branches to 3½ fingers on inner side of hand

ULNAR ARTERY

The larger branch of bifurcation of brachial half an inch below bend of elbow, or opposite neck of radius.

Deeply to near middle of inner border of forearm, lying upon brachialis anticus & flexor profundus and beneath median nerve and all the superficial muscles except flexor carpi ulnaris, and being at a distance from ulnar nerve.

Beneath skin and fascia only along front of inner border of forearm, lying, with ulnar nerve on its inner side, between flexor carpi ulnaris & flexor sublimis digitorum.

Over anterior annular ligament on outer side of pisiform bone & slightly in front of nerve.

Crosses palm of hand beneath skin & fascia and in front of flexor tendons & divisions of median & ulnar nerves, forming superficial palmar arch. This arch lies on a level with lower border of abducted thumb, a finger's breadth below deep palmar arch, and usually joins with superficialis volæ or radialis indicis, or sometimes with princeps pollicis.

BRANCHES:

Ant. ulnar recurrent — Small. Between pronator radii teres & brachialis anticus, and anastomoses with inferior profunda & anastomotica magna.

Post. ulnar recurrent — Larger. Beneath flexor sublimis, and then between olecranon & inner condyle beneath flexor carpi ulnaris, and anastomoses with interosseous recurrent, and with inferior profunda & anastomotica magna.

Interosseous — Thick, an inch in length, to upper border of interosseous membrane, where divides into:

ANT. INTEROSSEOUS — Down front of interrosseous membrane with corresponding branch of median nerve and between flexors longus pollicis & profundus digitorum. Behind pronator quadratus, and through lower part of interosseous membrane to back of carpus, where joins with posterior interosseous & posterior carpal arch. — Gives off a long slender twig to median nerve, and their nutrient arteries to radius & ulna.

POST. INTEROSSEOUS — Between interosseous membrane & oblique or round ligament, and then between superficial & deep muscles of back of forearm to back of carpus, where anastomoses with termination of anterior interosseous & with posterior carpal arch; gives off

INTEROSSEOUS RECURRENT — Beneath anconeus & supinator brevis to interval between olecranon & external condyle, and anastomoses with superior profunda & posterior ulnar recurrent.

Ant. Carpal — Joins with anterior carpal branch of radial beneath deep flexor tendons; gives twigs to articulations of carpus.

Post. carpal — Beneath tendon of flexor carpi ulnaris, and over back of carpus beneath extensor tendons, joining with posterior carpal branch of radial, and forming posterior carpal arch (Vide Radial artery). Sends a small branch along metacarpal bone of little finger.

Communicating — Between abductor & flexor brevis minimi digiti, and joins with termination of radial to complete deep palmar arch.

Superficial palmar interosseous (DIGITAL) — Usually four, but rather variable in size & number. Descend with terminal branches of median & ulnar nerves, first in front of, and then between, the flexor tendons (and on inner side of the innermost), and join with deep palmar interosseous branches from deep palmar arch. The trunks thus formed divide at clefts between fingers to form digital branches to 3½ fingers on inner side of hand.

MEDIAN & MUSCULO-CUTANEOUS NERVES.

MEDIAN NERVE.

From inner & outer cords of brachial plexus by two roots which surround 3rd part of axillary artery. – Lies at first on outer side (more or less so, but never quite in front) of 3rd part of axillary & upper part of brachial arteries.

Crosses brachial artery usually in front, and lies on its inner side at bend of elbow.

Between the two heads of pronator radii teres, and down middle of front of forearm, lying deeply at first between flexor sublimis & flexor profundus digitorum, and then superficially between tendon of flexor carpi radialis & outermost tendons of flexor sublimis.*

Beneath anterior annular ligament to palm of hand, where lies in front of flexor tendons, and becomes enlarged and flattened, and divides into two

TERMINAL BRANCHES:

External – Supplies abductor, opponens & outer head of flexor brevis pollicis, and gives palmar digital branches to thumb & outer side of index finger.

Internal – Supplies the two outer lumbricales, and gives palmar digital branches to contiguous sides of index, middle and ring fingers. – The digital nerves are superficial to the digital arteries.

LATERAL BRANCHES:

None in upper-arm. In fore-arm:

Muscular – Arise near elbow; to all the superficial muscles of front of fore-arm except flexor carpi ulnaris.

Ant. Interosseous – With anterior interosseous artery between flexor longus pollicis & flexor profundus digitorum, supplying the former & the outer half of the latter, and ends in pronator quadratus.

Palmar Cutaneous – From lower part. Pierces deep fascia a little above anterior annular ligament and supplies integument of palm of hand & ball of thumb, joining with palmar cutaneous branch of ulnar, and with radial or anterior branch of external cutaneous.

MUSCULO-CUTANEOUS or EXTERNAL CUTANEOUS NERVE.

From outer cord of brachial plexus in common with outer head of median.

Through coraco-brachialis, and between biceps & brachialis anticus to a little above external condyle, where perforates deep fascia, and divides, behind median cephalic vein, into:

Anterior Branch – Along front of radial side of fore-arm as low as wrist, where lies in front of radial artery, and joins with radial nerve. Sends filaments over ball of thumb, and accompanies radial artery to back of carpus.

Posterior Branch – Along back of radial side of fore-arm, joining with radial and with external cutaneous branch of musculo-spiral.

Supplies coraco-brachialis, biceps & brachialis anticus, and sends twigs to humerus & to elbow-joint.

*When palmaris longus is present, the nerve lies between it & flexor carpi radialis.

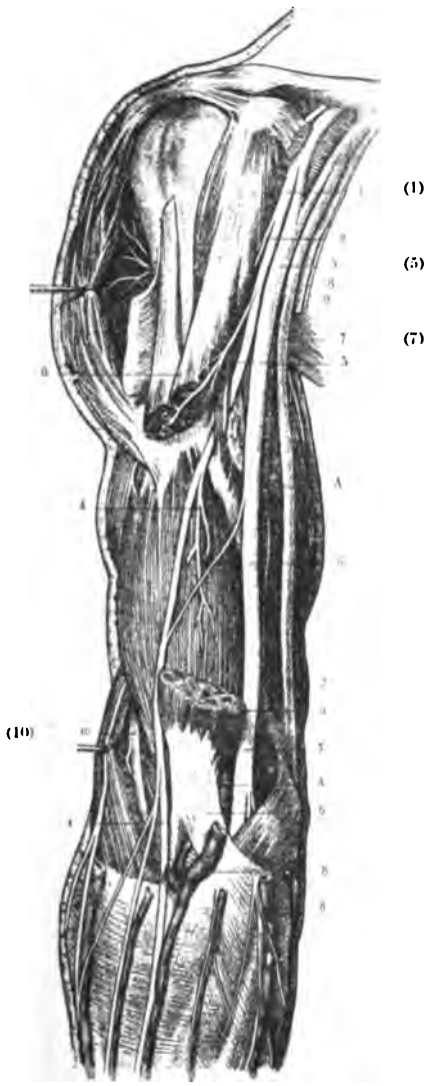


FIG. 196.—NERVES OF FRONT OF ARM. (Hirschfeld.)

1, musculo-cutaneous nerve; 5, median nerve; 7, ulnar nerve; 10, musculo-spiral nerve. (See expl., p. 60e.)

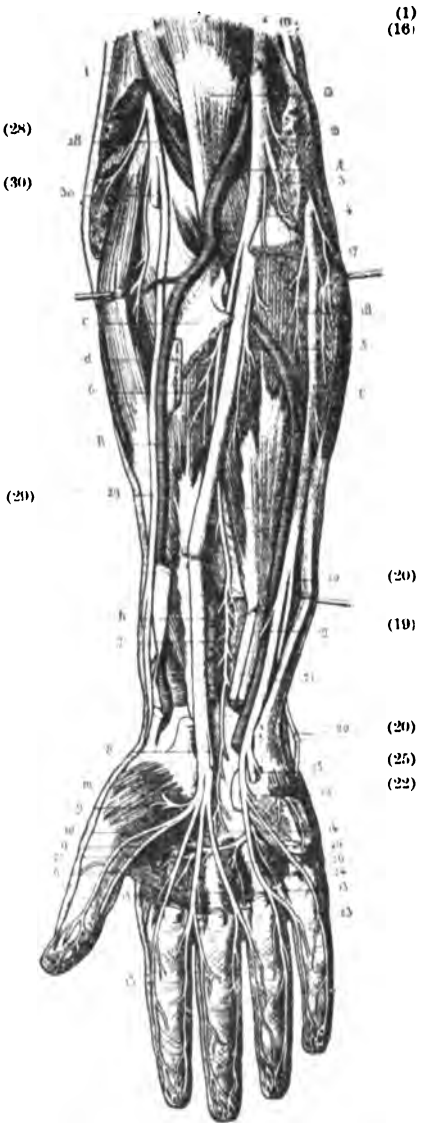


FIG. 197.—NERVES OF FRONT OF FOREARM. (Hirschfeld.)

1, median nerve; 16, ulnar nerve; 19, its dorsal cutaneous branch; 22, its superficial terminal branch; 25, its deep terminal branch; 28, musculo-spiral nerve; 29, radial nerve; 30, posterior interosseous nerve. (See expl., p. 60e.)

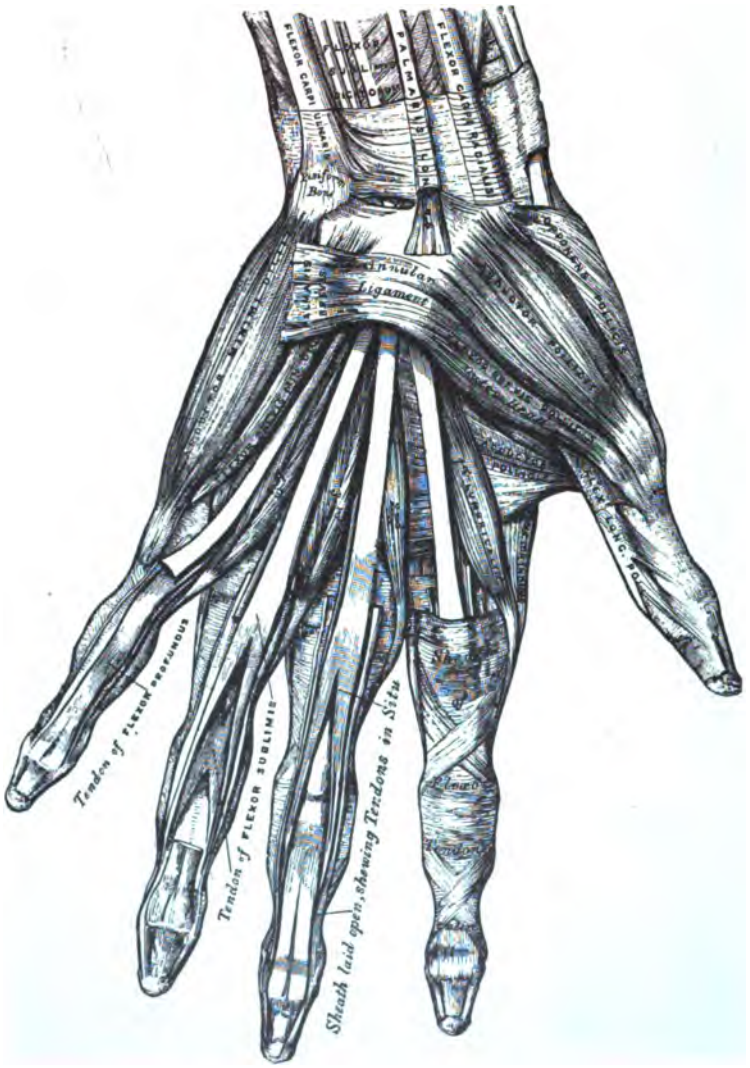


FIG 198.—THE MUSCLES OF THE PALM OF THE HAND. (Gray.)

ULNAR, INT. CUTANEOUS, & LESSER INT. CUTANEOUS NERVES.

ULNAR NERVE.

From inner cord of brachial plexus in common with inner head of median, internal cutaneous & lesser internal cutaneous nerves. – Lies at first on inner side of 3rd part of axillary & upper part of brachial arteries.

Pierces internal intermuscular septum with inferior profunda, and descends in groove between olecranon & internal condyle.

Enters fore-arm between the two heads of flexor carpi ulnaris.

Descends on flexor profundus, being covered in upper part of fore-arm by flexor carpi ulnaris, lying superficially in lower part between tendon of latter muscle & innermost tendons of flexor sublimis digitorum. – Ulnar artery lies on outer side of nerve, and is distant from it in upper part of fore-arm.

Crosses anterior annular ligament a little behind artery & on outer side of pisiform bone, and divides into two

TERMINAL BRANCHES:

Superficial – To palmaris brevis, integument & 1½ fingers on inner side of hand, joining with median.

Deep – Between abductor & flexor brevis minimi digiti, and beneath flexor tendons with deep palmar arch. Supplies muscles of little finger, interossei, the two inner lumbricales, adductor pollicis & inner head of flexor brevis.

LATERAL BRANCHES:

None in upper-arm. In fore-arm:

Articular to Elbow Joint – Several, small, arise behind elbow.

Muscular – To flexor carpi ulnaris & inner half of flexor profundus.

Palmar Cutaneous – Arises a little below middle of fore-arm. With ulnar artery to integument of front of wrist & palm of hand, joining with palmar cutaneous branch of median & frequently with internal cutaneous.

Dorsal Cutaneous – Large, arises a little above wrist. Winds inwards beneath tendon of flexor carpi ulnaris, and supplies integument & 1½ fingers on inner side of back of hand, joining with radial.

Articular to the Wrist.

INTERNAL CUTANEOUS NERVE.

From inner cord of brachial plexus in common with inner head of median, ulnar & lesser internal cutaneous nerves.

Along inner side of brachial artery in front of lesser internal cutaneous, giving off a cutaneous filament to integument over biceps.

Pierces deep fascia with basilic vein, and divides into:

Anterior Branch – In front of, or sometimes behind, median basilic vein to integument of front of inner side of fore-arm as low as wrist, frequently joining with palmar cutaneous branch of ulnar.

Posterior Branch – Over internal condyle to integument of back of inner side of fore-arm to near wrist, joining with lesser internal cutaneous & dorsal cutaneous branch of ulnar.

LESSER INTERNAL CUTANEOUS N. or N. of WRISBERG.

From inner cord of brachial plexus in common with inner head of median, ulnar & internal cutaneous nerves.

Along inner side of axillary vein & brachial artery & behind internal cutaneous nerve to integument of back of lower third of arm, joining with intercosto-humeral & posterior branch of internal cutaneous.

Its size & communications vary considerably. Frequently intercosto-humeral nerve is large, and takes the place of nerve of Wrisberg, joining brachial plexus by a small filament only, or not

MUSCLES of PALM of HAND.

MUSCLES of the THENAR EMINENCE or MS. of the THUMB.

Origin - Mast

Abductor Pollicis or Trapezo-phalangeal – Ridge on anterior surface of trapezium & anterior annular ligament of wrist.
Outer side of base of first phalanx of thumb. – S. by median nerve.

Opponens Pollicis or Trapezo-metacarpal – Front of trapezium below the ridge, & annular ligament.
Whole length of outer border of metacarpal bone of thumb. – S. by median n.

Flexor Brevis Pollicis or Trapezocarpo-phalangeal.
Outer or Superficial Head – Lower part of trapezium & anterior annular ligament.
Inner or Deep Head – Trapezoides, os magnum, base of 2nd & 3rd metacarpal bones.
Either side of base of first phalanx of thumb, a sesamoid bone being developed in each tendon. – S. by median nerve, & deep branch of ulnar.

Adductor Pollicis or Metacarpo-phalangeal – Lower two-thirds of anterior surface of 3rd metacarpal bone.
Inner side of base of first phalanx of thumb. – S. by deep branch of ulnar n.

MS. of HYPO-THENAR EMINENCE or MS. of LITTLE FINGER.

Palmaris Brevis – Annular ligament & inner edge of central palmar fascia.
Skin over inner border of hand. – S. by superficial branch of ulnar nerve.

Abductor Minimi Digiti, or Pisi-phalangeal – Pisiform bone, and slightly from tendon of flexor carpi ulnaris.
Inner side of base of first phalanx of little finger. – S. by deep branch of ulnar nerve.

Flexor Brevis Minimi Digiti, or Unci-phalangeal – Unciform process of unciform bone & annular ligament.
Inner side of base of first phalanx of little finger. – S. by deep branch of ulnar nerve.

Opponens or Adductor Minimi Digiti, or Unci-metacarpal* – Unciform process of unciform bone & annular ligament.
Whole length of inner border of metacarpal bone of little finger. – S. by deep branch of ulnar nerve.

*These names, expressive of the origin & insertion of the corresponding muscles, are due to Cruveilhier.

MUSCLES of the CENTRAL PALMAR REGION.

Lumbricales – First, and sometimes Second, from outer side of corresponding deep flexor tendon. – Third and Fourth, from adjoining sides of 2nd & 3rd and 3rd & 4th deep flexor tendons respectively.
Outer side of expansion of corresponding extensor tendon on back of first phalanges. – S., the two outer by median nerve; the two inner by deep branch of ulnar nerve.

Palmar Interossei – Three. – They arise from palmar half of one side of the metacarpal bone of one finger, and are inserted into the same side of the base of the first phalanx of the same finger & into the expansion of the extensor tendon which covers it. – They are situated respectively on the inner side of the 2nd metacarpal bone & index finger, and on the outer side of the 4th & 5th metacarpal bones and corresponding ring & little fingers. They adduct these fingers towards an imaginary line drawn through the long or middle finger. – They are supplied by the deep branch of the ulnar nerve.

Dorsal Interossei – Four – They arise by two heads from the adjacent sides of two metacarpal bones, but more extensively from the side of that metacarpal bone, which corresponds to the finger into which the muscle is inserted. They are inserted into the corresponding side of the base of the first phalanx of the corresponding finger & into the expansion of the corresponding extensor tendon. – They are situated respectively on the outer side of the 2nd metacarpal bone & index finger, on both sides of the 3rd metacarpal bone & middle finger, on the inner side of the 4th metacarpal bone & ring finger. The 1st dorsal interosseous muscle is larger than the others, and is sometimes called the abductor indicis; the radial artery passes between its two heads. – They abduct the fingers from an imaginary line drawn through the long or middle finger. – They are supplied by the deep branch of the ulnar nerve.

UPPER LIMB.

III.

PARTS ABOUT SHOULDER, BACK OF UPPER LIMB.

MUSCLES of UPPER LIMB—5th Tablet.

Deltoid – Upper surface & anterior border of outer half of clavicle; upper surface & outer border of acromion; whole length of lower lip of posterior border of spine of scapula.

Rough triangular prominence a little above middle of outer surface of shaft of humerus. – S. by circumflex nerve.

Subscapularis – Inner two-thirds of subscapular fossa; tendinous laminæ attached to ridges of said fossa; aponeurosis which separates it from teres major.

Into lesser tuberosity of humerus and by fleshy fibres into the neck for a short distance lower down. – S. by the two upper subscapular nerves from posterior cord of brachial plexus.

Supraspinatus – Inner two-thirds of supraspinous fossa & fascia which covers it.

Highest of the three facets on greater tuberosity of humerus. – S. by suprascapular nerve.

Infraspinatus – Inner two-thirds of infraspinous fossa & ridges on its surface; fasciæ which separate it from the teres major & minor.

Middle facet on greater tuberosity of humerus. – S. by suprascapular nerve.

Teres Minor – Upper two-thirds of dorsal aspect of axillary border of scapula; intermuscular septa which separate it from infraspinatus & teres major.

Lowest facet on greater tuberosity of humerus and by fleshy fibres into the neck for a short distance lower down – S. by a branch of circumflex nerve.

Teres Major – Dorsal aspect of inferior angle of scapula; intermuscular septa which separate it from infraspinatus & teres minor.

Inner or posterior edge of bicipital groove of humerus. – S. by a branch from lower subscapular nerve.

Latissimus Dorsi – Spinous processes of the 6 or 7 lower dorsal vertebræ; by the posterior layer of lumbar aponeurosis, from the lumbar & sacral spines and the back part of outer lip of crest of ilium; from outer lip of crest of ilium for an inch or more in front of lumbar aponeurosis; from the last three or four ribs interdigitating with external oblique; sometimes by a few fibres from inferior angle of scapula.

Bottom of bicipital groove of humerus a little higher up than teres major by a broad flat tendon twisted upon itself. – S. by long subscapular nerve.

Levator Anguli Scapulæ – Posterior tubercles of transverse processes of the 3, 4, or 5 upper cervical vertebræ between splenius & scalenus medius.

Posterior border of scapula between spine & superior angle. – S. by one of the deep branches of the cervical plexus and by one of the supra-clavicular branches of the brachial plexus.

Rhomboideus Minor – Ligamentum nuchæ and spinous processes of 7th cervical & 1st dorsal vertebræ.

Posterior border of scapula opposite triangular smooth surface at root of spine. – S. by one of the deep branches of cervical plexus and by one of the supra-clavicular branches of the brachial plexus.

Rhmoboideus Major – Spinous processes of the 4 or 5 upper dorsal vertebræ and supra-spinous ligament.

Base of scapula between spine and inferior angle (Quain, Ellis), or rather into a tendinous arch attached to the triangular smooth surface at root of spine & to the inferior angle and connected to posterior border of scapula by a thin membrane (Gray). – S. by one of the deep branches of the cervical plexus and by one of the supra-clavicular branches of the brachial plexus.

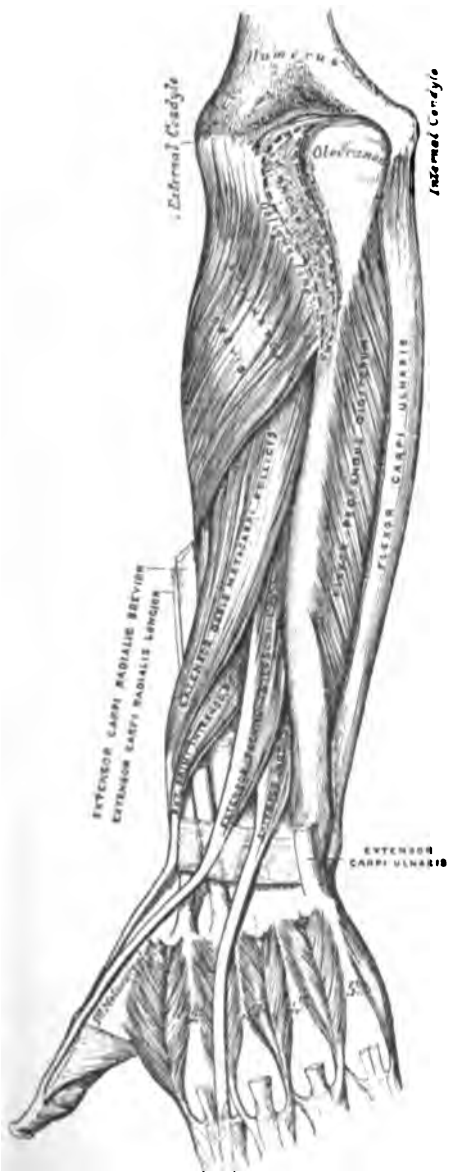


FIG. 199.—THE DEEP MUSCLES OF THE BACK OF THE FOREARM. (Gray.)

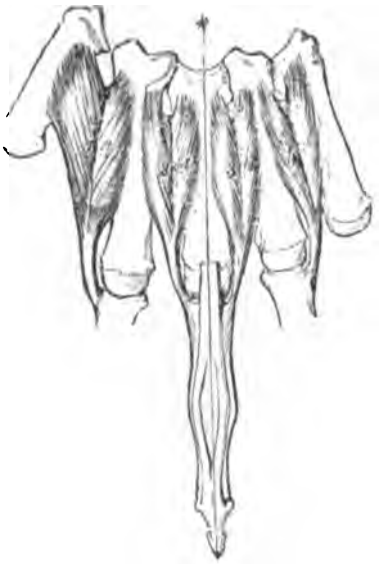


FIG. 200.—THE DORSAL INTEROSSEI MUSCLES. (Gray.)

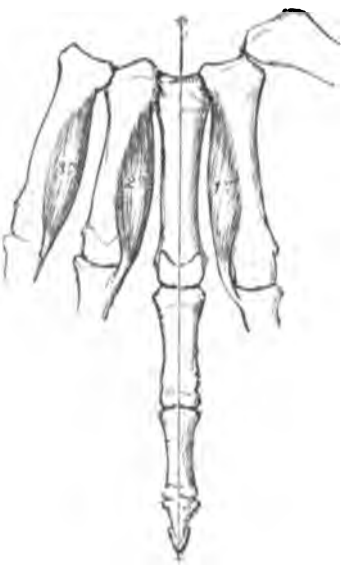


FIG. 201.—THE PALMAR INTEROSSEI MUSCLES. (Gray.)

LANE LIBRARY

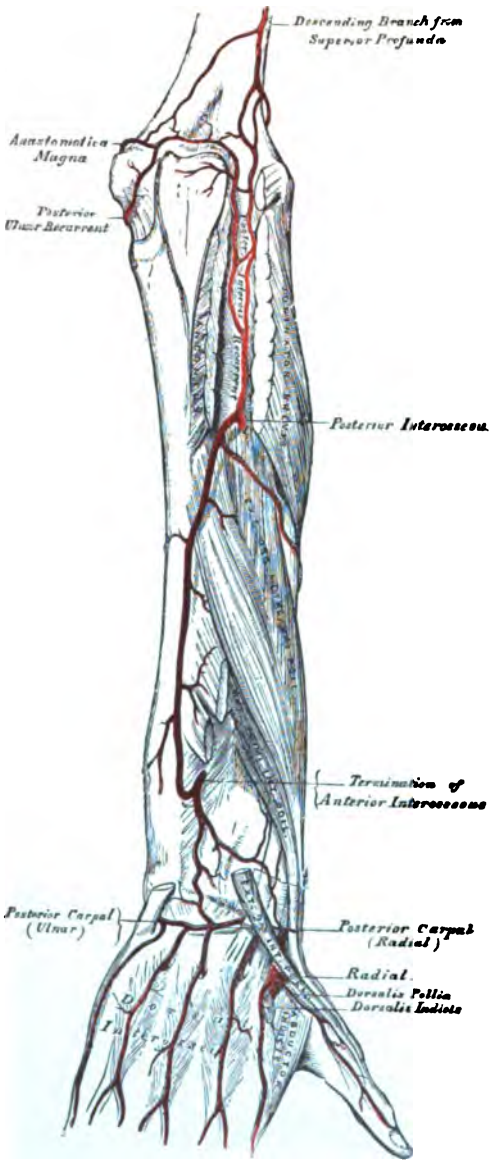


FIG. 202.—ARTERIES OF THE BACK OF THE FOREARM AND HAND. (Gray)

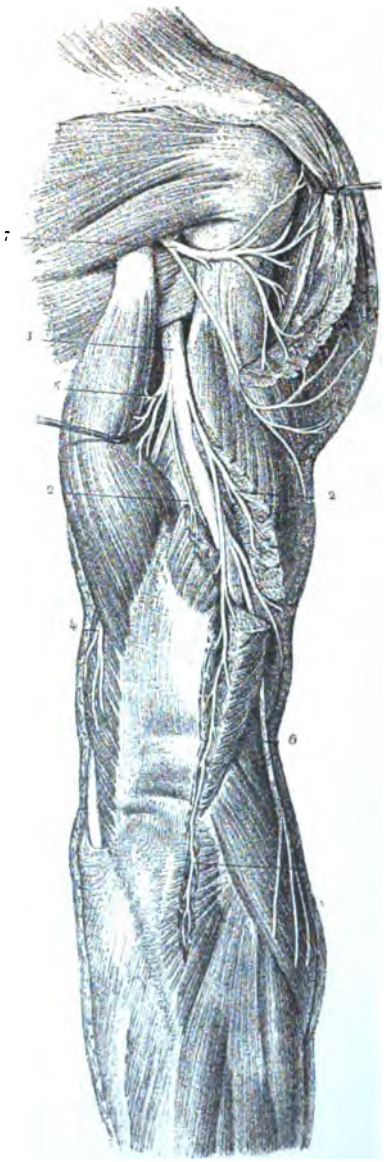


FIG. 203.—MUSCULO-SPIRAL & CIRCUMFLEX NERVES. (Hirschfeld.)
1, musculo- spiral nerve; 7, circumflex nerve.
(*See* expl., p. 60f.)

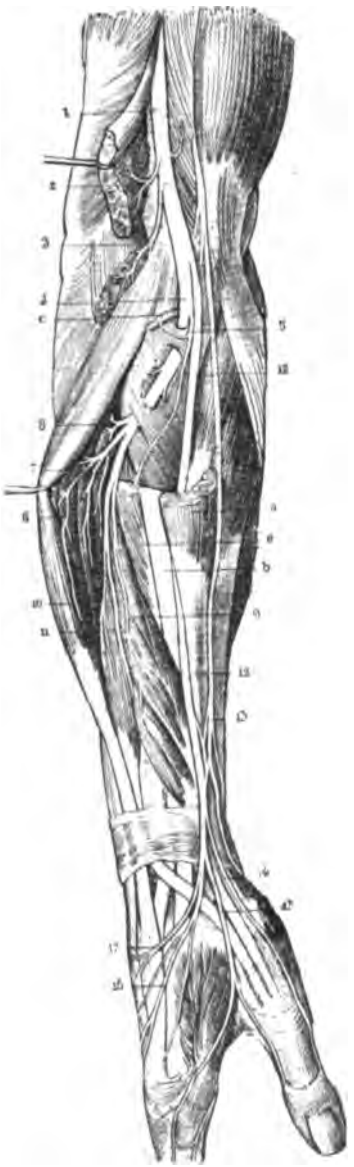


FIG. 204.—MUSCULO-SPIRAL, RADIAL, & POSTERIOR INTEROSSEOUS NERVES. (Hirschfeld.)

1, musculo-spiral nerve; 4, trunk of the posterior interosseous nerve; 12, 12, radial nerve.

(*See* expl., p. 60f.)

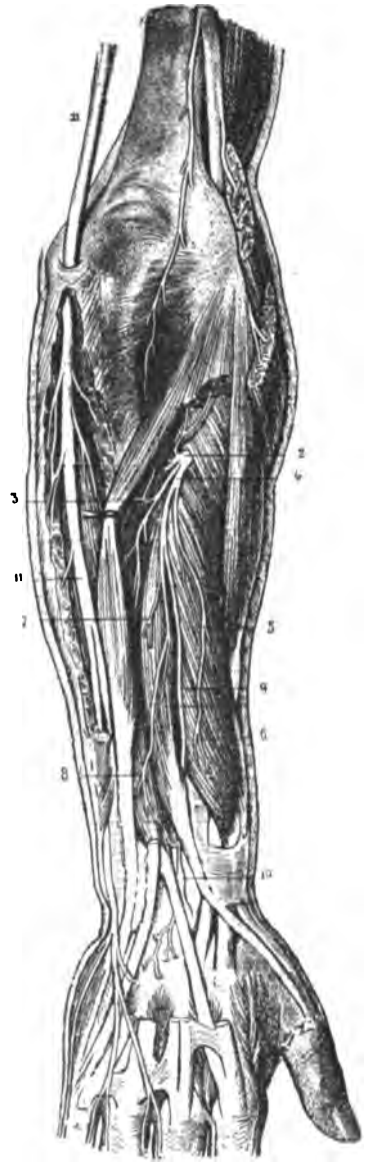


FIG. 205.—MUSCULO-SPIRAL, POSTERIOR INTEROSSEOUS ULNAR NERVES. (Hirschfeld.)

1, musculo-spiral nerve; 2, posterior interosseous nerve; 11, ulnar nerve.

(*See* expl., p. 60f.)

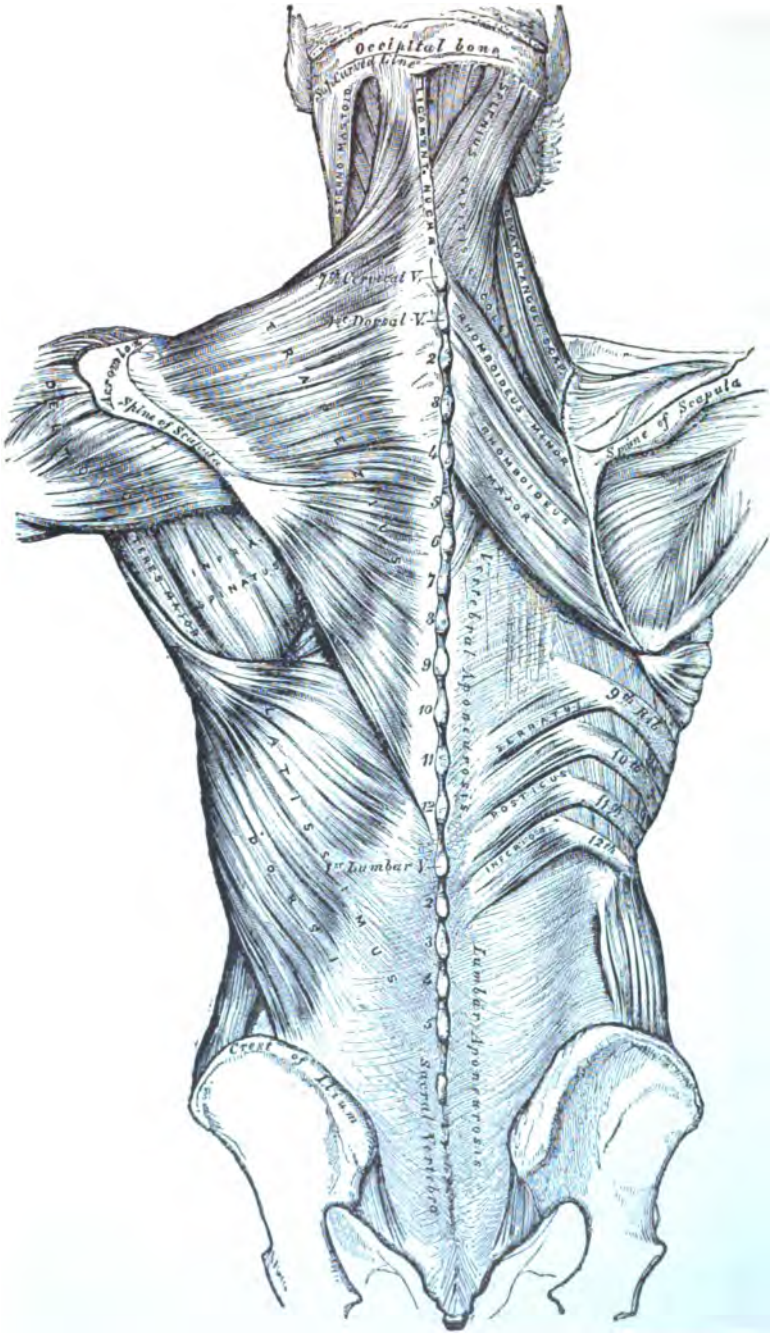


FIG. 206.—MUSCLES OF THE BACK—FIRST, SECOND, AND PART OF THE THIRD LAYERS. (Gray.)

MUSCLES of UPPER LIMB—6th Tablet.

MUSCLES of BACK of FOREARM.

SUPERFICIAL LAYER.

Extensor Communis Digitorum – External condyle of humerus by the common tendon; deep fascia; intermuscular septa on either side.
Bases of 2nd & 3rd phalanges of the four fingers. – S. by posterior interosseous nerve.

Extensor Minimi Digiti – External condyle of humerus by the common tendon; deep fascia; intermuscular septa on either side.
Joins corresponding tendon of extensor communis. The common tendon thus formed is inserted into bases of 2nd & 3rd phalanges of little finger. – S. by posterior interosseous nerve.

Extensor Carpi Ulnaris – External condyle of humerus by the common tendon; middle third of posterior border of shaft of ulna; deep fascia; septum between it & foregoing muscle. Usually it simply covers, but sometimes it arises from, narrow portion of posterior surface of shaft of ulna internal to the vertical ridge.
Base of metacarpal bone of little finger. – S. by posterior interosseous n.

Anconeus – Back of outer condyle of humerus; deep fascia.
Rough triangular surface on outer side of olecranon & upper third of shaft of ulna. – S. by musculo-spiral nerve.

DEEP LAYER.

Supinator Brevis – External condyle of humerus; external lateral ligament of elbow-joint; orbicular ligament of radius; triangular depression below lesser sigmoid cavity & ridge behind the depression.
Inner, anterior, and outer aspects of radius above bicipital tuberosity & oblique line as low down as insertion of pronator radii teres. – S. by posterior interosseous nerve.

Extensor Ossis Metacarpi Pollicis – Outer half of posterior surface of shaft of ulna below insertion of anconeus; posterior surface of interosseous membrane; middle third of posterior surface of shaft of radius.
Base of first metacarpal bone. – S. by posterior interosseous nerve.

Extensor Primi Internodii Pollicis – Posterior surface of radius below foregoing muscle; interosseous membrane.
Base of first phalanx of thumb. – S. by posterior interosseous nerve.

Extensor Secundi Internodii Pollicis – Middle of outer half of posterior surface of shaft of ulna; posterior surface of interosseous membrane.
Base of terminal phalanx of thumb. – S. by posterior interosseous nerve.

Extensor Indicis – Posterior surface of shaft of ulna below foregoing muscle; interosseous membrane.
Joins corresponding tendon of extensor communis. The common tendon thus formed is inserted into bases of 2nd & 3rd phalanges of index finger. – S. by posterior interosseous nerve.

POSTERIOR BRACHIAL REGION.

Triceps:

Long Head – Rough triangular depression below glenoid cavity of scapula, and slightly from capsule of shoulder-joint.

Outer Head – Posterior surface of shaft of humerus above musculo-spiral groove; outer border of humerus; external intermuscular septum.

Inner Head – Posterior surface of shaft of humerus below musculo-spiral groove; inner border of humerus; internal intermuscular septum.

By a strong tendon into back part of upper surface of olecranon process of ulna. – S. by musculo-spiral nerve.

Subanconeus – Posterior surface of humerus above olecranon fossa.
Posterior ligament of elbow joint – S. by musculo-spiral nerve.

(Group 5th Cervical nerves as supplying musculo-Spiral)

MUSCULO-SPIRAL & CIRCUMFLEX NERVES.

MUSCULO-SPIRAL NERVE

The largest branch of brachial plexus. Arises from posterior cord in common with circumflex, and lies at first behind 3rd part of axillary artery & upper part of brachial.

Downwards & outwards in front of tendons of teres major & latissimus dorsi, and in spiral groove with superior profunda artery.

Between brachialis anticus & supinator longus to front of external condyle, where it divides into radial & posterior interosseous nerves. Its branches are:

Muscular – To triceps, anconeus, brachialis anticus, supinator longus, extensor carpi radialis longior.

Cutaneous – Three, small, one internal, two external; to integument of inner & posterior, and of outer & anterior aspects of arm, and of outer aspect of fore-arm.

RADIAL NERVE — The smaller.

Down front of outer side of fore-arm beneath supinator longus, lying on outer side of radial artery, which artery is distant from it in upper third & close to it in middle third. Winds outwards & backwards beneath tendon of supinator longus about three inches above wrist, pierces deep fascia, and divides into branches:

EXTERNAL – The smaller. To outer side & ball of thumb; joins with posterior branch of external cutaneous.

INTERNAL – The larger. To integument, & remainder of 3½ fingers on outer side of hand; joins with external cutaneous & with dorsal cutaneous branch of ulnar. – Adjoining sides of middle & ring fingers may be supplied by same nerve, which may be either the radial or the ulnar.

POSTERIOR INTEROSSEOUS NERVE — The larger.

Through substance of supinator brevis to back of fore-arm.

Between superficial & deep muscles of posterior aspect of fore-arm, supplying them all except anconeus, supinator longus, & extensor carpi radialis longior.

Beneath extensores secundi internodii pollicis & communis digitorum to back of carpus, where it becomes ganglionic and supplies articulations of wrist.

CIRCUMFLEX NERVE

From posterior cord of brachial plexus in common with musculo-spiral.

Downwards & outwards behind axillary artery in front of subscapularis.

Backwards, with posterior circumflex vessels, through quadrilateral space bounded by teres major, teres minor, long head of triceps, & humerus. Gives off a small twig to shoulder-joint, and divides into:

Superior Branch – The larger. Round neck of humerus as far as anterior border of deltoid; supplies deltoid, and gives off cutaneous filaments which perforate the muscle to integument over lower part of shoulder.

Inferior Branch – The smaller. Supplies teres minor, back part of deltoid, & integument over back of shoulder; has frequently a gangliform enlargement on branch to teres minor.

MUSCULAR ATTACHTS. of BS. of UPPER LIMB—1st T.

The muscles attached to the

CLAVICLE — Are six in number, and are attached as follows: –

Sterno-Cleido-Mastoid – Anterior surface & upper border of inner third.
Pectoralis Major – Anterior surface & anterior border of inner half.
Deltoid – Upper surface & anterior border of outer half.
Trapezius – Upper surface & posterior border of outer third.
Subclavius – Groove on under surface of middle third.
Sterno-Cleido-Hyoid – Sometimes, from back of inner extremity.

SCAPULA — Seventeen in number, and are attached as follows: –

Supraspinatus – Inner two-thirds of supraspinous fossa.
Infraspinatus – Inner two-thirds of infraspinous fossa & ridges on its surface.
Teres Major – Posterior aspect of inferior angle.
Teres Minor – Upper two-thirds of posterior aspect of axillary border.
Deltoid – Upper surface & outer border of acromion, whole length of lower lip of posterior border of spine.
Trapezius – Upper surface and inner border of acromion, whole length of upper lip of posterior border of spine.
Subscapularis – Inner two-thirds of subscapular fossa & ridges on its surface.
Serratus Magnus – Whole length of anterior lip of posterior border.
Rhomboideus Major – Posterior border between spine & inferior angle.
Rhomboideus Minor – Posterior border opposite triangular smooth surface at root of spine.
Levator Anguli Scapulæ – Posterior border between spine & superior angle.
Omo-Hyoid – Upper border on inner side of suprascapular notch.
Long Head of Triceps – Rough triangular depression below glenoid cavity.
Pectoralis Minor – Inner border of coracoid process.
Coraco-Brachialis, *Short Head of Biceps* – Tip of coracoid process.
Long Head of Biceps – Top of glenoid cavity.
Latissimus Dorsi – Sometimes, from back of inferior angle.

MUSCULAR ATTACHTS. of BS. of UPPER LIMB—2nd T.

The muscles attached to the

HUMERUS — Are twenty-four in number, and are attached as follows: –

Supraspinatus – Highest of the three facets on greater tuberosity.
Infraspinatus – Middle facet on greater tuberosity.
Teres Minor – Lowest facet on greater tuberosity, and by a few fleshy fibres into the neck for a short distance lower down.
Subscapularis – Lesser tuberosity, and by a few fleshy fibres into the neck for a short distance lower down
Teres Major – Inner or posterior edge of bicipital groove.
Pectoralis Major – Anterior or outer edge of bicipital groove.
Latissimus Dorsi – Bottom of bicipital groove.
Deltoid – Rough triangular prominence a little above middle of outer surface of shaft.
Coraco-Brachialis – Rough impression a little above middle of inner surface of shaft.
Brachialis Anticus – Lower half of inner & outer surfaces of shaft.
Inner & Outer Heads of Triceps –
Inner head – Posterior surface of shaft below musculo-spiral groove, inner border.
Outer head – Posterior surface of shaft above musculo-spiral groove, outer border.
Supinator Longus – Upper two-thirds of external condyloid ridge.
Extensor Carpi Radialis Longior – Lower third of external condyloid ridge.
Extensor Carpi Radialis Brevior – External condyle.
Extensor Communis Digitorum – ,,
Extensor Minimi Digiti – ,,
Extensor Carpi Ulnaris – ,,
Anconeus – ,,
Supinator Brevis – ,,
Pronator Radii Teres (Inner Head) – Inner condyle & internal condyloid ridge im

Flexor Carpi Radialis – Inner condyle.
Palmaris Longus – ,,
Flexor Carpi Ulnaris (Anterior or Inner Head) – Inner condyle
Flexor Sublimis Digitorum (Inner Head) – ,,

FIG. 207.—MUSCLES ON THE DORSUM OF THE SCAPULA AND THE TRICEPS. (GRAY.)

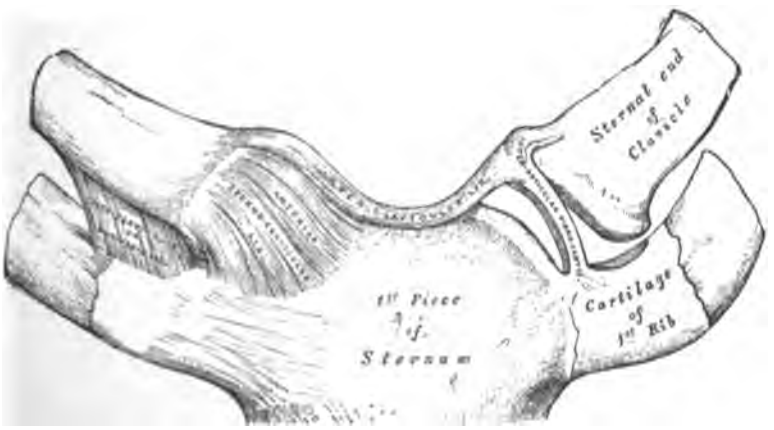
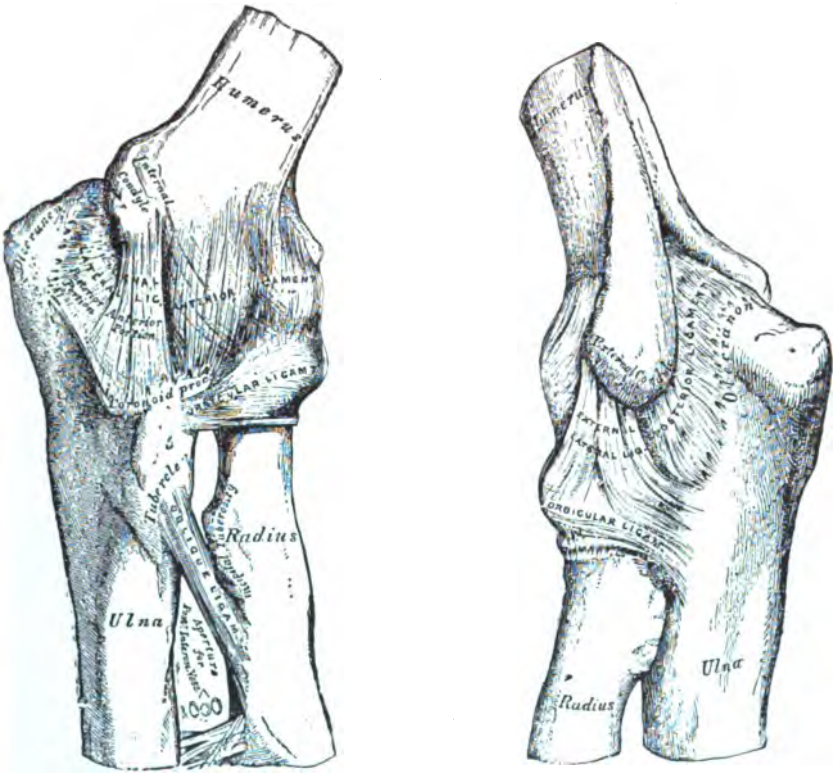


FIG. 208.—STERNO-CLAVICULAR ARTICULATION. (Gray.)



FIGS. 209 & 210.—ANTERIOR AND POSTERIOR ASPECTS OF THE LEFT ELBOW-JOINT. (Gray.)

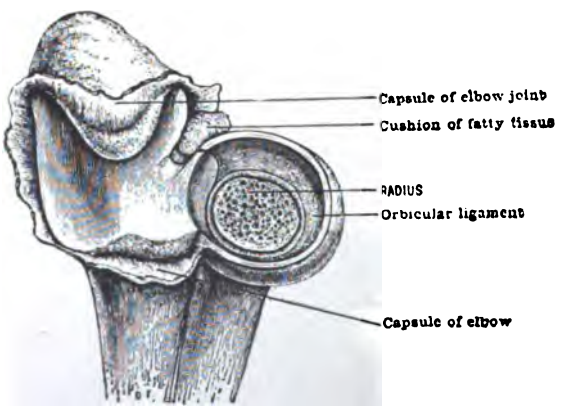


FIG. 211.—ORBICULAR LIGAMENT OF RADIUS (Morris.)

MUSCULAR ATTACHTS. of BS. of UPPER LIMB—3rd T.

The muscles attached to the

RADIUS — Are nine in number, and are attached as follows: –

Biceps – Back part of bicipital tuberosity.
Supinator Brevis – Inner, anterior & outer aspects of the bone above bicipital tuberosity & oblique line as low down as insertion of pronator radii teres.
Flexor Sublimis Digitorum (Outer Head) – Oblique line.
Pronator Radii Teres – Rough impression on middle of outer surface of shaft.
Flexor Longus Pollicis – Upper two-thirds of anterior surface of shaft.
Pronator Quadratus – Lower fourth of anterior surface & outer border.
Extensor Ossis Metacarpi Pollicis – Middle third of posterior surface of shaft.
Extensor Primi Internodii Pollicis – Posterior surface of shaft below foregoing.
Supinator Longus – Outer side of base of styloid process.

ULNA — Are thirteen in number, and are attached as follows: –

Supinator Brevis – Triangular depression below lesser sigmoid cavity & ridge behind the depression.
Brachialis Anticus – Under surface of coronoid process.
Flexor Sublimis Digitorum (Middle Head) – Tubercle on inner surface of coronoid process above pronator radii teres.
Pronator Radii Teres (Outer Head) – Ridge on inner surface of coronoid process below flexor sublimis.
Flexor Profundus Digitorum – Depression on inner surface of coronoid process, upper two-thirds of anterior & inner surfaces, and, by an aponeurosis which is common to it & to flexor carpi ulnaris, upper two-thirds of posterior border.
Flexor Carpi Ulnaris (Posterior Head) – Inner border of olecranon, and by an aponeurosis which is common to it & to flexor profundus, upper two-thirds of posterior border.
Triceps – Back part of upper surface of olecranon.
Anconeus – Rough triangular surface on outer side of olecranon & upper third of shaft.
Pronator Quadratus – Lower fourth of anterior surface & inner border.
Extensor Carpi Ulnaris – Middle third of posterior border. Usually it simply covers, but sometimes it arises from, narrow portion of posterior surface internal to the vertical ridge.
Extensor Ossis Metacarpi Pollicis – Outer half of posterior surface below insertion of anconeus.
Extensor Secundi Internodii Pollicis – Middle of outer half of posterior surface.
Extensor Indicis – Posterior surface below foregoing.

Ligaments of Scapula { 1. Glenoid 2. Supra-scapular 3. Transverse

Helps to ligam.. = arm / Shoulder-joint { Coraco - Brachialis Supra - Spinatus Infra - " Sub - Scapularis Teres " Biceps

THE SHOULDER-JOINT.

Is an enarthrodial articulation, though not a typical one; for the glenoid cavity of the scapula is, in comparison with the head of the humerus, remarkably small & shallow, and there is little more than a mere apposition between the two bones. Considerable mobility is thus provided for. Displacement is, on the other hand, prevented to a great extent by the presence of the acromion & coracoid processes & coraco-acromial ligament. — The articular cartilage is thickest in the centre, on the head of the humerus, thickest at the periphery, on the glenoid cavity.

LIGAMENTS:

Capsular – From
Neck of scapula round margin of glenoid cavity to
Anatomical neck of humerus, extending farthest down humerus along its inner aspect.

This capsule is thicker above than below. It is strengthened by the coraco-humeral ligament externally, by the tendons of the supra- & infraspinatus & teres minor behind, and by that of the subscapularis in front.

It has two, sometimes three openings, through which the synovial membrane is prolonged upon the tendons of the subscapularis & biceps, and sometimes upon that of the infraspinatus. The tendon of the long head of the biceps perforates the lower part of the capsule, and becomes surrounded, within the joint, by a complete sheath of synovial membrane.

It is remarkably loose, and, when the muscles are cut, it admits of the bones being separated more than an inch. The bones are therefore kept in apposition less by the ligaments themselves than by muscular action & atmospheric pressure.

Coraco-humeral, or Accessory – Strong flat band intimately blended with the capsule, and extending obliquely from
Root & outer border of coracoid process to
Front of great tuberosity of humerus.

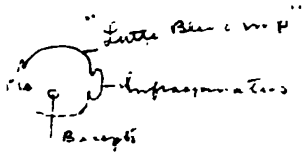
Glenoid – Would be better described as an extension of the glenoid cavity than as a ligament, for, unlike the cotyloid ligament of the hip-joint, it does not assist in keeping the bones together. It is a fibro-cartilaginous ring triangular on section; its thickest portion is attached to the circumference of the glenoid cavity, and its sharp edge is free. It is continuous above with the tendon of the long head of the biceps, by the bifurcation of which it is partly formed.

SYNOVIAL MEMBRANE — Is prolonged through the above mentioned openings in the capsule
Upon the tendon of the biceps, in the shape of a complete sheath, which allows the tendon to traverse the articular cavity without being contained therein;
Upon the tendon of the subscapularis in the shape of a pouch of variable size comprised between the tendon & the subscapular fossa; and sometimes
Upon the tendon of the infra-spinatus in a similar manner; an independent bursa existing at other times between the muscle & the infraspinous fossa. – An independent bursa exists between the upper part of the capsule & the coraco-acromial ligament & deltoid.

VASCULAR & NERVE SUPPLY — From the circumflex & supra-scapular vessels & nerves.

MOVEMENTS — The shoulder joint is the freest of all the joints of the body, and admits of movement in every direction. The acromion & coracoid processes & the coraco-acromial ligament prevent displacement upwards of the head of the humerus and limit, unless the scapula be displaced, the elevation of the arm to about the horizontal position.

Internal r



THE ELBOW-JOINT.

Is a ginglymoid articulation between the trochlea & the radial tuberosity or capitellum of the humerus, on the one hand, and, on the other, the greater sigmoid cavity of the ulna & the cup-shaped depression on the head of the radius. – The articular surfaces of the radius & ulna are continuous with those of the superior radio-ulnar articulation.

LIGAMENTS — Are:

Anterior – Broad & pretty thick layer of superficial oblique & deeper vertical fibres extending from
Inner condyle & front of humerus just above coronoid fossa to
Orbicular ligament of radius & under surface of coronoid process of ulna, – to which vertical & oblique fibres a few transverse ones are added.

Posterior – Thin & membranous; consists of a few irregular fibres mainly transverse, which connect
Apex & sides of olecranon process to
Margin of olecranon fossa.

External Lateral – Thick, strong, triangular, shorter & narrower than the internal; from
External condyle to
Orbicular ligament of radius & outer border of ulna.

Internal Lateral – Thick, strong, triangular; longer & broader than foregoing, and divided into anterior & posterior portions extending respectively from
Front, and from *lower & back part of inner condyle*, respectively to
Inner border of coronoid process, and *inner border of olecranon.*

SYNOVIAL MEMBRANE — Lines the coronoid & olecranon fossæ, and dips down between the articular surfaces of the superior radio-ulnar articulation.

VASCULAR & NERVE SUPPLY – From the superior & inferior profunda, & the radial, ulnar & interosseous recurrent arteries, and from the ulnar & musculo-cutaneous nerves.

MOVEMENTS — Flexion & extension only, which are limited by the locking of the coronoid & olecranon processes in their respective fossæ. – The inner border of the trochlea descending lower than the outer one, the axis of rotation is oblique downwards & inwards; the path of motion lies, therefore, in a plane, oblique downwards & outwards, which circumstance, as is remarked by Cruveilhier, brings the hand during flexion naturally and without effort towards the mouth.

RADIO-ULNAR ARTICULATIONS.

Three in number, superior, middle, & inferior, the middle one consisting merely of two ligaments, the interosseous & the oblique or round.

SUPERIOR RADIO-ULNAR ARTICULATION — Lateral ginglymus or diarthrosis rotatorius between circumference of head of radius, on the one hand, and lesser sigmoid cavity & inner surface of orbicular ligament of radius, on the other, the lesser sigmoid cavity corresponding to the broad inner part, and the orbicular ligament to the narrow outer part of the radial articular surface. – The only ligament is the

Orbicular Ligament – Strong flat band, the four-fifths of a ring, which extends, round head & upper part of neck of radius, from

Anterior extremity to *Posterior extremity of lesser sigmoid cavity of ulna.*

The circumference of its lower border is narrower than that of its upper border, so that the head of the radius is maintained by it both against the ulna & against the capitellum of the humerus. Its inner surface is lined by the synovial membrane, and forms part of the articular surfaces of the joint. Its outer surface gives attachment to external lateral ligament of elbow-joint and to supinator brevis muscle.

MIDDLE RADIO-ULNAR ARTICULATION.

Interosseous Ligament – Strong aponeurotic plane of fibres which pass obliquely downwards & inwards between

Contiguous borders of radius & ulna.– It is broadest towards middle, perforated inferiorly for anterior interosseous vessels, and deficient above from about an inch below tubercle of radius, thus leaving for posterior interosseous vessels an opening bounded superiorly by the

Oblique or Round Ligament – Narrow fasciculus oblique downwards & outwards from

Coronoid process to
Radius half an inch below bicipital tuberosity.

INFERIOR RADIO-ULNAR ARTICULATON — Lateral ginglymus or diarthrosis rotatorius between head of ulna & sigmoid cavity of radius, to which is added an arthrodia between under surface of head of ulna & the triangular fibro-cartilage of the articulation. – The ligaments are:

Ant. Radio-Ulnar – Narrow band from
Anterior extremity of sigmoid cavity to
Front of head of ulna.

Post. Radio-Ulnar – Narrow band from
Posterior extremity of sigmoid cavity to
Back of head of ulna.

Triangular Fibro-Cartilage – The principal band of union, triangular, from
Lower margin of sigmoid cavity of radius to
Depression at root of styloid process of ulna.

Fig 216

Its upper & under surfaces are lined respectively with the synovial membranes of the inferior radio-ulnar & radio-carpal articulations, and they come in contact, the one with the head of the ulna, the other with the cuneiform bone. Its margins are blended with the surrounding ligaments. It is thinnest in the centre, and sometimes perforated; the two synovial membranes above mentioned are then continuous with each other.

Synovial Membrane – Is very loose, and is termed the *membrana sacciformis.* It extends between the triangular fibro-cartilage & the head of the ulna, and becomes continuous, when the former is perforated, with the synovial membrane of the wrist-joint.

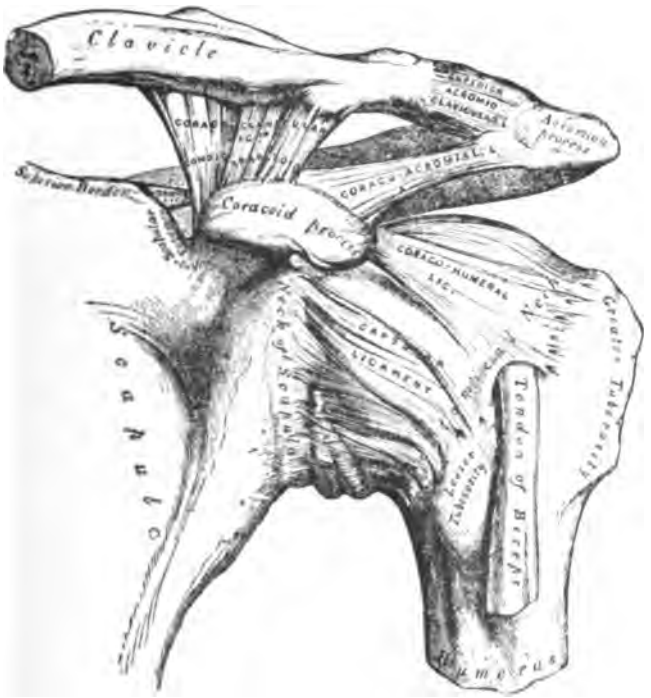


FIG. 212.– SHOULDER-JOINT, ACROMIO-CLAVICULAR ARTICULATION, AND PROPER LIGAMENTS OF SCAPULA. (Gray.)

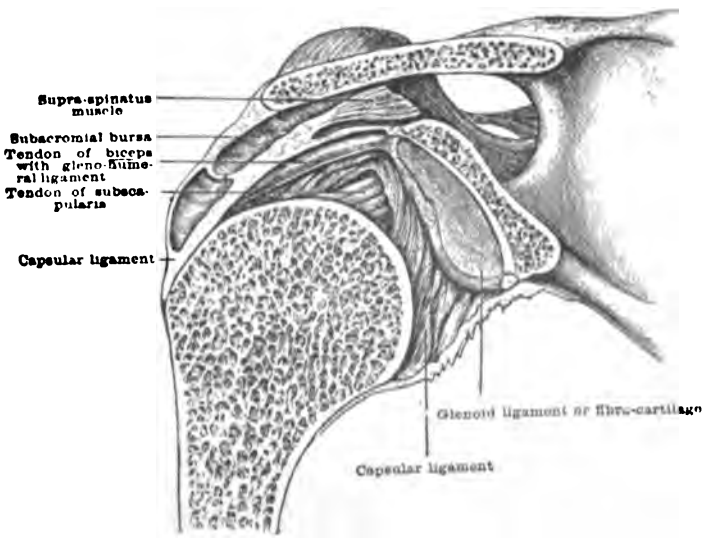


FIG. 213.—THE GLENO-HUMERAL LIGAMENT. (Morris.)

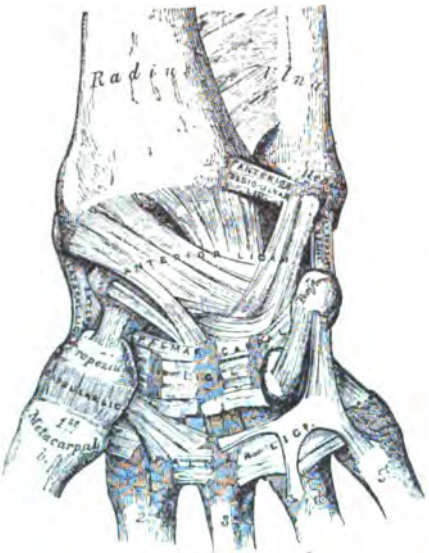


FIG. 214.—LIGAMENTS OF WRIST AND HAND, ANTERIOR VIEW. (Gray.)

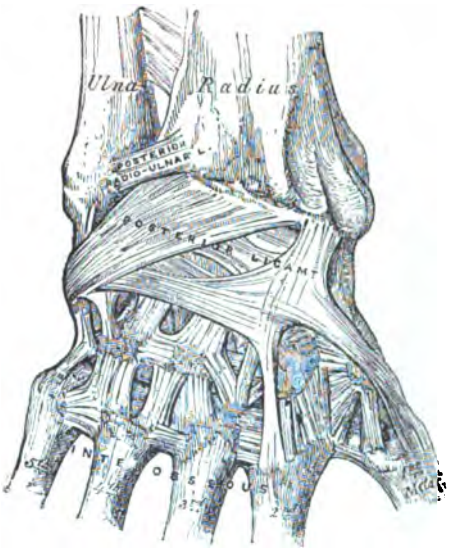


FIG. 215.—LIGAMENTS OF WRIST AND HAND, POSTERIOR VIEW. (Gray.)

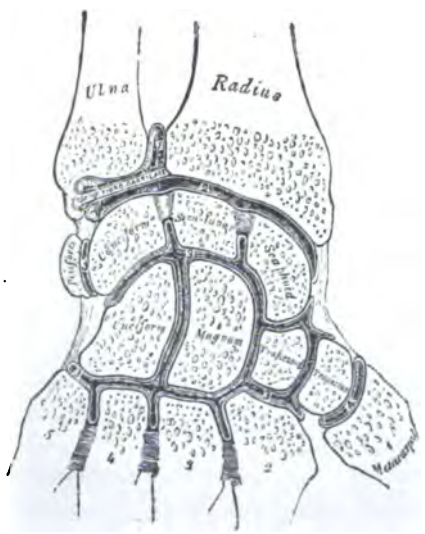


FIG. 216.—VERTICAL SECTION OF WRIST, SHOWING THE SYNOVIAL MEMBRANES. (Gray.)

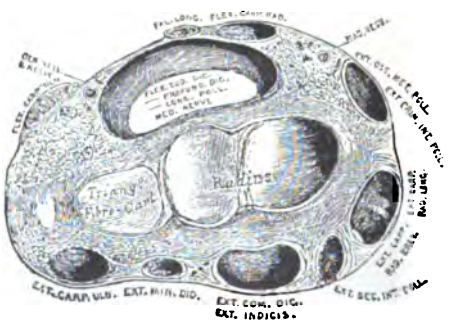


FIG. 217.—TRANSVERSE SECTION THROUGH THE RIGHT WRIST-JOINT SEEN FROM ABOVE, SHOWING THE ANNULAR LIGAMENTS AND THE CANALS FOR THE PASSAGE OF THE TENDONS. (Gray.)

THE WRIST-JOINT.

Is a condyloid articulation.

ARTICULAR SURFACES:

THE CONDYLE – Is formed by three bones, the scaphoid, semilunar, & cuneiform.

THE RECEIVING CAVITY – Is formed by the under surface of the radius & by the triangular fibro-cartilage of the inferior radio-ulnar articulation. – The under surface of the radius is divided by a linear elevation into two portions, the outer triangular, the inner quadrilateral, which portions correspond respectively to the scaphoid and the semilunar; the cuneiform articulates with the under surface of the triangular fibro-cartilage

LIGAMENTS:

External Lateral – Short strong band, from

Apex of styloid process of radius to

Outer side of scaphoid & trapezium, & anterior annular ligament of carpus.

Internal Lateral – Round cord, from

Apex of styloid process of ulna to

Cuneiform & pisiform bones, & anterior annular ligament.

Anterior – Strong & broad membrane, from

Front of head of ulna, anterior margin of radius & its styloid process to

Scaphoid, semilunar, cuneiform, & slightly to os magnum.

Posterior – Thinner, from

Posterior margin of radius to

Scaphoid, semilunar & cuneiform.

VASCULAR & NERVE SUPPLY — Anterior & posterior carpal branches of radial & ulnar, anterior & posterior interosseous arteries, ascending branches of deep palmar arch. – Ulnar nerve

MOVEMENTS — All but rotation.

FASCIÆ & SYNOVIAL MEMBRANES of the HAND & WRIST.

FASCIÆ — Are rather ligaments than fasciæ proper, and are therefore described here.

Anterior Annular Ligament of the Wrist – Continuous above with deep fascia of forearm, and below with palmar fascia; extends from
Pisiform bone & unciform process of unciform to
Tubercle of scaphoid, & ridge on anterior surface of trapezium.
It is pierced by tendon of flexor carpi radialis.
Beneath it pass the flexores sublimis & profundus digitorum enclosed in one synovial sheath, the flexor longus pollicis enclosed in another sheath, and the median n.
Into its anterior surface & upper border are inserted a few fibres of the palmaris longus & flexor carpi ulnaris.
From its lower border arise in part the abductor, opponens & outer head of flexor brevis pollicis, and the flexor brevis & opponens minimi digiti.

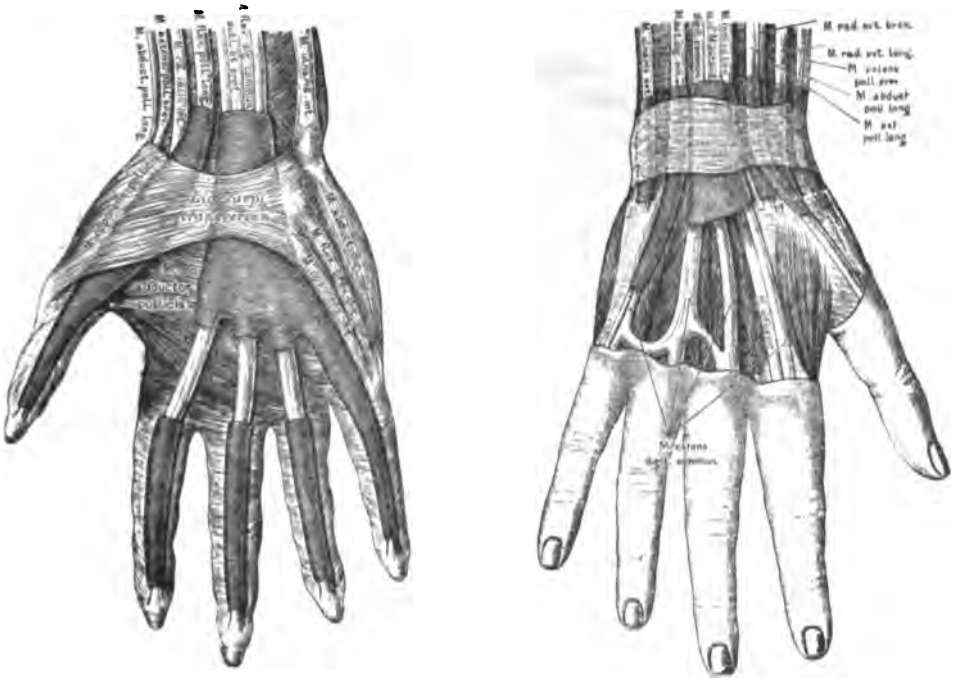
Posterior Annular Ligament of the Wrist – Thinner than foregoing, from
Cuneiform & pisiform bones, and lower part of ulna to
Styloid process & ridges on posterior aspect of radius.
Presents six divisions or compartments lined each of them with a separate synovial membrane, and which, from without inwards, correspond to the following osseous grooves, and transmit the following muscles:–
1. – *Corresponds to shallow groove on outer side of styloid process of radius. – Transmits extensores ossis metacarpi & primi internodii pollicis.*
2. – *Corresponds to broad & shallow groove on posterior aspect of styloid process. – Transmits extensores carpi radiales longior & brevior.*
3. – *Corresponds to narrow & deep groove on back of lower extremity of radius. – Transmits extensor secundi internodii pollicis.*
4. – *Corresponds to broad & shallow groove on back of lower extremity of radius. – Transmits extensores indicis & communis digitorum.*
5. – *Corresponds to groove at point of articulation of radius & ulna. – Transmits extensor minimi digiti.*
6. – *Corresponds to groove on back of head of ulna. – Transmits extensor carpi ulnaris.*

Palmar Fascia — Consists of
Two Lateral Portions – Thin. Cover muscles of thumb & little finger, and send processes between them.
Central Portion – Thick, strong, triangular; firmly adherent to integument; covers superficial palmar arch, flexor tendons, & median & ulnar nerves, and gives origin internally to palmaris brevis. It is narrow above, where it receives expanded tendon of palmaris longus, and is attached to anterior annular ligament; and broad below, where it divides into four slips bound together by transverse fibres. Each slip subdivides into two processes, which processes embrace the flexor tendons, and become attached to bases of first phalanges & glenoid ligaments. Between the slips are seen the palmar interosseous & digital arteries, the terminal branches of the median & ulnar nerves, & the tendons of the lumbricales.

SYNOVIAL MEMBRANES — Are articular & tendinous.

Articular – Five:–
1. – *Membrana Sacciformis* of the inferior radio-ulnar articulation.
2. – *Synovial membrane of the radio-carpal articulation*, comprised between the first row of carpal bones & the under surface of the radius & triangular fibro-cartilage.
3. – *General synovial membrane of the carpus*, comprised between bones of first row, between bones of second row, between the two rows of bones, between the second row of carpal bones & the four inner metacarpal bones, and finally between the four inner metacarpal bones.
4. – *Synovial membrane of the carpo-metacarpal articulation of the thumb.*
5. – *Synovial membrane of the articulation between the cuneiform & pisiform.*

Tendinous – Vide Anterior & Posterior Annular Ligaments.



FIGS. 217A & B.—DISSECTION OF THE SYNOVIÆ OF THE FLEXOR AND EXTENSOR SHEATHS OF THE WRIST AND HAND. (A. Heitzmann.)

FIG. 217C.—DIAGRAM OF THE FLEXOR SYNOVIAL SHEATHS. (Anderson, Heath.)

FIG. 217D.—DEEP DISSECTION OF THE ELBOW-JOINT. (A. Heitzmann.)

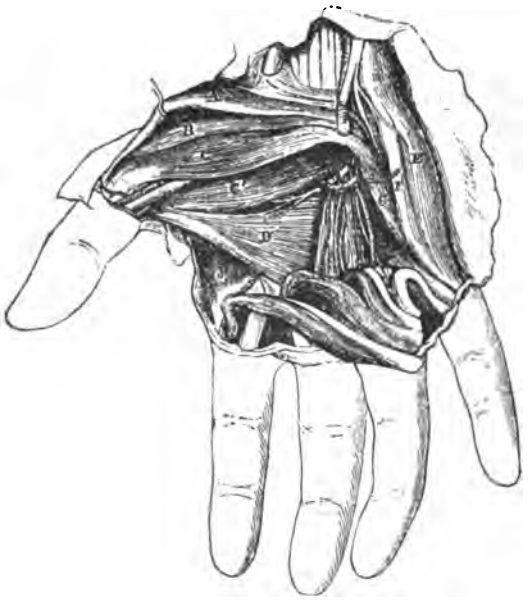
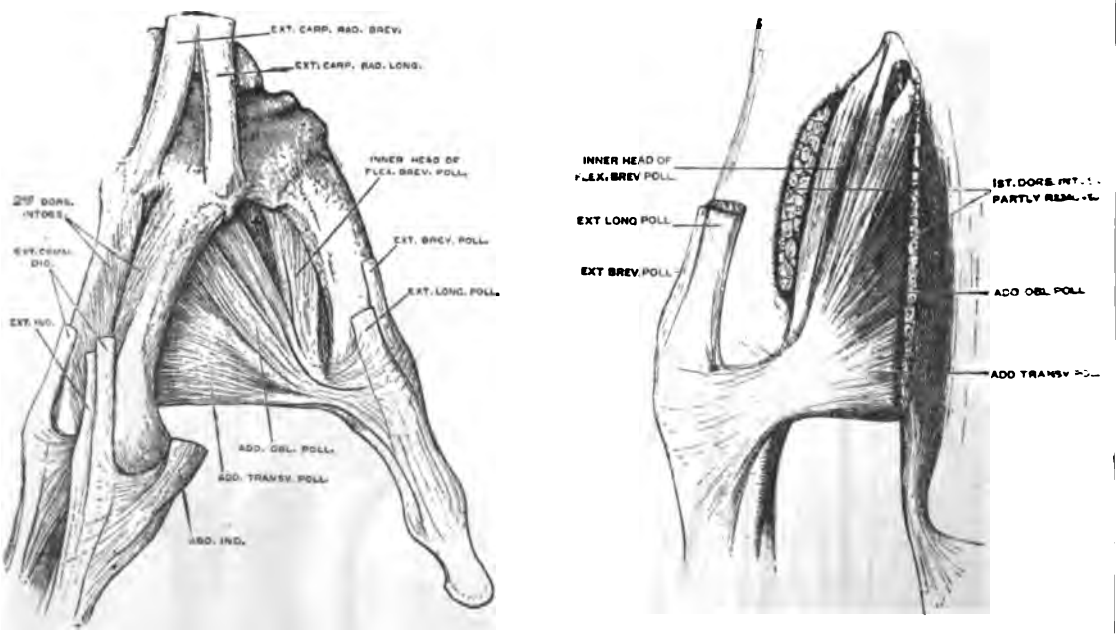


FIG. 217E.—DEEP DISSECTION OF THE PALM OF THE HAND. (Ellis.)
(See expl., p. 60f.)



FIGS. 217F & G.—BACK OF THE HAND, SHOWING THE NEW INNER HEAD OF THE FLEXOR BREVIS POLLICIS AND OTHER MUSCLES.
(A, Quain; B, Parsons, in Heath's Anatomy.)

NOTES ON THE NEWER MATTER.

Insertion of the Pectoralis Major.

The tendon of the pectoralis major consists of anterior and posterior laminæ continuous with each other inferiorly. The anterior and thicker lamina receives from above downwards the clavicular and the upper half of the sternal fibres. The posterior and thinner lamina receives inferiorly the lower half of the sternal fibres, and superiorly the fibres from the abdominal aponeurosis and the costal cartilages; this lamina reaches higher up on the humerus than the anterior one; it may be considered to give off the expansion which covers in the bicipital groove.

Insertion of the Deltoid.

The coarseness of the deltoid is due in a measure to the special arrangement of its central fibres. It is only a portion of these that are directly attached either to the scapula or to the humerus. In the substance of the central portion of the muscle are some seven or more alternating septa or tendinous intersections, four of which, as a rule, are attached to the acromion, and the rest to the humerus. The greater part of the more central fibres are directly attached to these in a more or less bipenniform fashion.

Flexor Brevis, & Adductor Obliquus Pollicis.

Pursuant to investigations by Prof. Cunningham on the Muscles of the Manus and Pes, a new description is now given of the above. What has hitherto been called the "Inner head of the Flexor Brevis Pollicis" is now by some termed the "Adductor Pollicis Obliquus," and an additional inner head is found for the "Flexor Brevis" in the shape of a small slip arising from the inner side of the base of the first metacarpal bone.

The Flexor Brevis Pollicis is still therefore a two-headed muscle. Its outer head is correctly given in the older descriptions, and likewise is its insertion. Its *inner head* is a small slip arising from the inner side of the base of the first metacarpal bone. Its nerve-supply remains the same as formerly, – the outer head being supplied by the outer division of the median nerve, and the inner head by the deep division of the ulnar.

"Adductor Obliquus Pollicis" is simply a new name therefore for the "Inner head of the Flexor Brevis."

First Dorsal, or First Thoracic Nerve.

It is only a portion, though by far the larger portion, of the anterior division of the first dorsal nerve that enters into the composition of the brachial plexus. This nerve, after emerging from the intervertebral foramen between the first and second thoracic vertebræ, gives off an intercostal branch, the first intercostal nerve, which is a very small one, however. It then crosses the inner border and the upper surface of the first rib to join the eighth cervical nerve and form part of the brachial plexus.

The outer and inner primary cords of the brachial plexus are frequently joined, the former by a twig from the fourth cervical nerve, the latter by a twig from the second thoracic.

Dorsal Digital Nerves to the Fingers and Toes.

It has long been made out, and the arrangement was represented in Hirschfeld's plates, that the adjacent sides of the big and second toes are supplied by the bifurcation of a short common trunk formed by the union of two twigs derived, one from the anterior tibial nerve, and the other from the inner branch of the musculo-cutaneous.

Through the investigations of Dr. H. St. John Brooks, as reported in the treatise on Anatomy edited by Mr. Henry Morris, it would appear that similar arrangements pertain in respect of the dorsal digital nerves both to the adjacent sides of the third and fourth toes, and to the adjacent sides of the third and fourth fingers. In respect of the Dorsal Digital nerves to the fingers, considerable further interest attaches to the above-mentioned investigations. It is shown by Dr. St. John Brooks that the radial and ulnar nerves not only do not supply the whole extent of the dorsal aspect of the several fingers, but further do not supply the dorsal aspect of the several fingers equally. Thus, while the dorsal aspect of the thumb and little finger are supplied by the corresponding branches of the radial and ulnar nerves down to the matrix of the nail, the index and ring fingers are supplied by the corresponding nerves down to the distal interdigital joint only, and the middle finger not further than the proximal interdigital joint. The portions of the dorsal aspect of the several fingers left unsupplied by the dorsal digital nerves are supplied by twigs from the *palmar* digital branches of the median and ulnar nerves.

As the radial and ulnar nerves overlap in their distribution on the dorsum of the hand, a considerable part of the central portion of the dorsum of the hand is supplied conjointly by both these nerves.

The nerve-supply to the palmar, or plantar, aspect of the adjacent sides of the middle and ring fingers, and of the third and fourth toes, is similarly divided between the median and ulnar nerves, and the internal and external plantar nerves, respectively.

Capsule of the Shoulder-Joint.

The capsule of the shoulder-joint is strengthened by three supplementary bands, of which two lie on its outer, and one on its inner aspect. On the outer aspect there is an *inner* band (Flood's ligament), which runs along the lower border of the subscapularis extending from the glenoid cavity to the lower part of the lesser tuberosity of the

humerus; and an *inferior* band (Schlemm's ligament), extending from the under part of the glenoid cavity to the under part of the neck of the humerus. The third band, or *gleno-humeral ligament*, is attached to the upper part of the glenoid cavity at the root of the coracoid process, just internal to the tendon of the long head of the biceps; it descends at an acute angle to the tendon, forming a groove for the same, and is attached inferiorly to the lesser tuberosity of the humerus. It is a thin ribbon-like band, of which the upper surface is attached to the capsule, while the other is free and projects into the joint, forming a groove for the tendon of the biceps. In the fœtus it is often, and in the adult occasionally, quite free from the capsule, and may be as thick as the tendon of the biceps (H. Morris). (See also p. 108g.)

Transverse Humeral Ligament.

Mr. Gordon Brodie describes under the above name the band of fibrous tissue which covers in the bicipital groove, and transforms it into an osteo-aponeurotic canal. This band is supposed to correspond to a process of bone which joins the greater and lesser tuberosities of the humerus in the musk ox. It is strengthened by an expansion from the deep lamina of the tendon of the pectoralis major.

Costo-coracoid Membrane.

The costo-coracoid membrane is thick and dense where it is stretched between the clavicle, the coracoid process, the inner extremity of the first rib, and the upper border of the pectoralis minor. It is here perforated by the cephalic vein, the acromio- and superior thoracic vessels and the anterior thoracic nerves. The portion extending from the first rib to the coracoid process is specially dense, and is often called the costo-coracoid *ligament*. Superiorly, the costo-coracoid membrane may be said to enclose the subclavius muscle, and to become continuous with the deep cervical fascia. Inferiorly it may be said to enclose the pectoralis minor, and to be joined to the axillary fascia. But these extensions are cellular rather than aponeurotic.

See also notes on—

The Coraco-Brachialis, p. 108c.

The Epitrochleo-Anconeus, p. 108a.

The Rotator Humeri, p. 108c.

The Internal Intermuscular Septum of Arm, p. 108d.

The Palmar Fascia, p. 108e.

The Deep Fascia of the Limbs, p. 108a.

The Supra-Condyloid Foramen, p. 108f.

The Morphology of the Arteries of the Limbs, p. 96c.

The Morphology of the Nerves of the Limbs, p. 96d.

The Vas Aberrans Humeri, p. 96c.

The Pseudo-Ganglia, p. 96d.

The Typical Shoulder Girdle, including notes on the following Ligaments:—

COSTO-CLAVICULAR OR RHOMBOID, INTERCLAVICULAR, CONOID & TRAPEZOID, AND GLENO-HUMERAL; CORACO-ACROMIAL AND SUPRA-SCAPULAR; AND THE INTERCLAVICULAR FIBRO-CARTILAGES OF THE STERNO-CLAVICULAR AND ACROMIO-CLAVICULAR ARTICULATIONS, p. 108g.

EXPLANATION OF FIGURES NOT FULLY EXPLAINED IN THE TEXT.

UPPER LIMB.

FIG. 187.—ARTERIAL TRUNKS AND NERVES OF UPPER LIMB—ANTERIOR VIEW. (Hirschfeld.)

1, 2, 2, 3, median nerve; 4, 5, 6, 7, ulnar nerve; 8, its superficial, and 9, 9, its deep terminal branches; 10, internal cutaneous nerve; 11, lesser internal cutaneous nerve; 12, musculo-cutaneous nerve; 13, musculo-spiral nerve; 14, radial nerve; 15, posterior interosseous nerve.

FIG. 189.—BEND OF LEFT ELBOW. (Morris.)

1, anastomotica magna artery; 2, internal cutaneous nerve; 3, posterior ulnar vein; 4, 4, brachialis anticus; 5, anterior ulnar vein; 6, deep median vein; 7, ulnar artery; 8, radial artery; 9, external cutaneous nerve; 10, musculo-spiral nerve; 11, radial vein; 12, posterior interosseous nerve; 13, radial recurrent artery; 14, median vein; 15, radial nerve.

FIG. 196.—NERVES OF FRONT OF ARM. (Hirschfeld.)

(1) **Musculo-cutaneous nerve**, with its branches, 2, to coraco-brachialis, 3, to biceps, 4, to brachialis anticus; (5) **median nerve**, with, 6, its anastomosis with the musculo-cutaneous; (7) **ulnar nerve**; 8, internal cutaneous nerve, divided; 9, lesser internal cutaneous nerve, divided (10) **musculo-spiral nerve.**

A, A, brachial artery; B, median basilic vein; *a*, *a*, biceps divided, with, *b*, the bicipital fascia separating the median basilic vein from the brachial artery.

FIG. 197.—NERVES OF FRONT OF FOREARM. (Hirschfeld.)

(1) **Median nerve**, giving off muscular branches to, 2, pronator radii teres, 3, flexor carpi radialis & palmaris longus, 4, flexor sublimis, 5, outer half of flexor profundus, 6, flexor longus pollicis, 7, pronator quadratus (anterior interosseous branch), 9, abductor oponens, & outer head of flexor brevis pollicis, 15, the two outer lumbricales, 8, its palmar cutaneous branch, divided; 10, 11, 12, 13, 14, palmar digital branches to three and a half fingers on outer side of hand; (16) **ulnar nerve**, giving off muscular branches to 17, flexor carpi ulnaris, 18, inner half of flexor profundus; (19 & 20) its **palmar & dorsal** cutaneous branches; (22) its **superficial terminal** branch; 23 and 24, palmar digital branches to one and a half fingers on inner side of hand; (25) its **deep terminal** branch, supplying, 26, the interossei & two inner lumbricales, and, 27, the adductor pollicis; (28) **musculo-spiral nerve**; (29) **radial nerve**; (30) **posterior interosseous nerve.** *c*, radial origin of flexor sublimis; *d*, insertion of pronator radii teres; *h*, pronator quadratus, divided; *m*, abductor pollicis; *n*, adductor pollicis, partly cut away.

FIG. 203.—MUSCULO-SPIRAL & CIRCUMFLEX NERVES. (Hirschfeld.)

(1) **Musculo-spiral nerve**, in groove of same name, giving off branches, 2, to outer head of triceps, 3, to anconeus, 4, to inner head of triceps, 5, to long head of triceps; 6, external cutaneous branch; (7) **circumflex nerve**, emerging from quadrilateral space, winding round neck of humerus, and dividing into upper & lower branches; the origin of the nerve to the teres minor is just visible.

FIG. 204.—MUSCULO-SPIRAL, RADIAL, & POSTERIOR INTEROSSEOUS NERVES. (Hirschfeld.)

(1) **Musculo-spiral nerve** above bend of elbow, giving off muscular branches, 2, to supinator longus, 3, to extensor carpi radialis longior; (4) **trunk of the posterior interosseous nerve**, giving off its branch to the extensor carpi radialis brevior, piercing the supinator brevis, of which a small portion is removed, and appearing, greatly diminished in size, between the superficial & deep muscles of the back of the forearm, where it gives off branches to, 6, extensor communis digitorum, 7, extensor minimi digiti, 8, extensor carpi ulnaris 9 extensor ossis metacarpi pollicis & primi internodii pollicis, 10, secundo internodii pollicis & indicis; (12, 12) **radial nerve**; 13, external cutaneous nerve, joining with the foregoing; 14 to 16, dorsal digital branches to three and a half fingers on outer side of hand; 17, branch joining with the ulnar nerve. *a*, *b*, *c*, lower portions of the divided supinator longus, extensor carpi radialis longior, and extensor carpi radialis brevior; the tendons of the two latter muscles are very distinct as they emerge from beneath the posterior annular ligament at the back of the wrist.

FIG. 205.—MUSCULO-SPIRAL, POSTERIOR INTEROSSEOUS, & ULNAR NERVES. (Hirschfeld.)

(1) **Musculo-spiral nerve**, with its branches to anconeus, supinator longus, and extensor carpi radialis longior; (2) **posterior interosseous nerve** emerging from supinator brevis, and giving off 3, 3, branches to superficial muscles of back of forearm, and 4, branches to the deep muscles, namely, to, 5, extensor ossis metacarpi pollicis, 6, extensor primi internodii pollicis, 7, extensor secundi internodii pollicis, 8, extensor indicis; 9, terminal portion, greatly diminished, of the posterior interosseous nerve passing beneath the extensores secundi internodii pollicis & indicis, and showing its pseudo-ganlion, 10; (11) **ulnar nerve**, first entering the forearm between the two heads of the flexor carpi ulnaris, and then shown lower down through the partial removal of this muscle.

FIG. 217B.—DEEP DISSECTION OF THE PALM OF THE HAND. (Ellis.)

A, B, C, C′, D, abductor, opponens, outer head of flexor brevis, adductor obliquus, and adductor transversus pollicis; E, F, G, abductor, flexor brevis, and adductor or opponens minimi digiti.

SUMMARY OF PRACTICAL POINTS.

UPPER LIMB.

Clavicle.—Convex anteriorly, and rounded in its inner two-thirds; concave anteriorly, and flattened from above downwards in its outer third; forms a nearly horizontal buttress, through which the shoulder is supported on the sternum.

Head of the Humerus.—Projects beyond the acromion when the arm hangs down by the side, thus causing the convexity of the shoulder. When the arm is raised, the convexity is replaced by a slight depression, and the head of the humerus can then be felt in the axilla.

The **greater tuberosity** faces in the direction of the outer condyle.

The **articular surface** faces in the direction of the inner condyle.

The **lesser tuberosity** looks forwards and slightly inwards.

The **bicipital groove** faces directly forwards.

The upper epiphysis of the humerus includes the articular surface and both tuberosities.

Coracoid Process.—Its inner border lies behind the intermuscular space between the deltoid and the pectoralis major. Its apex lies somewhat beneath the deltoid. Both can be distinctly felt when the arm is abducted.

Axillary Artery.—Lies first just to the *inner side of the coracoid process*, and can here be compressed against the second rib, though with difficulty, and not for long. The position of the artery is here indicated by a line drawn from junction of outer and middle thirds of clavicle to outer part of axilla.

Lower down the artery lies *behind the coraco-brachialis and short head of the biceps*, on the inner side of the head of the humerus. This being depressed by the raising of the arm, the artery can be compressed against it in the outward direction. The position of the artery is here indicated by a

line drawn from junction of the anterior and middle thirds of axilla to a point midway between the condyles of the humerus; which line also indicates, lower down, the position of the brachial artery.

Folds of Axilla.—*Anterior fold* corresponds to fifth rib; *posterior fold* descends a little lower. Highest digitation of *serratus magnus* usually visible in axilla corresponds to sixth rib.

Paracentesis thoracis may conveniently be performed between the fifth and sixth ribs, or between the sixth and seventh, a little above and in front of the lower angle of the scapula.

Boundaries of the Axilla, with their Vessels and Nerves:—

Anterior Wall.—Formed by pectoralis major, behind which are the costo-coracoid membrane and the pectoralis minor. The costo-coracoid membrane is perforated by the cephalic vein, the anterior thoracic nerves, and numerous branches of the acromio-thoracic vessels.

Posterior Wall.—Formed by the subscapularis, teres major, and latissimus dorsi. Presents the subscapular vessels and nerves, and the circumflex vessels and nerve.

Inner Wall.—Formed by the serratus magnus, four first ribs, and intercostal muscles. Presents the long thoracic or external mammary artery, with the thoracic branches of the acromio-thoracic and the superior thoracic; also the long thoracic or external respiratory nerve of Sir Charles Bell; also numerous lymphatic glands lying in the course of the lymphatic vessels from the chest wall and breast.

Outer Wall.—Narrow; formed by the biceps and coraco-brachialis, and the humerus. Presents the axillary artery and vein, and the cords of the brachial plexus.

Apex.—Corresponds to the interval between the clavicle, the first rib, and the upper border of the scapula.

Base.—Formed by the strong deep fascia extending from the pectoralis major to the teres major and latissimus dorsi. It is tensed in the abducted position of the arm, and relaxed in the adducted position, in which latter position the arm should always be placed for the exploration of the axilla.

Deltoid.—Can be raised from the shoulder when the arm is abducted, so as to allow, to some extent, of the formation of a deltoid flap by transfixion. Over its insertion is a slight depression, which was formerly selected as a convenient seat for setons and issues.

Brachial Artery.—Runs along a line drawn from *junction of anterior and middle thirds of axilla* to *midway between condyles of humerus.* It lies just beneath inner border of the biceps, and is crossed from without inwards by median nerve. It may be compressed backwards and outwards on shaft of humerus along whole of its course.

Cutaneous Veins.—On the inner side of the artery, in its lower half, is the *basilic vein*, accompanied by the internal cutaneous nerve. The *cephalic vein* runs in the groove on the outer side of the biceps, then between the pectoralis major and the deltoid, and finally opens into the axillary above the coracoid process.

Musculo-Spiral Nerve and Superior Profunda Artery.—Wind obliquely round back of humerus a little above its middle. Below this, for three or four inches above the condyles, there is nothing to interfere with operations on the bone.

Bend of the Elbow.—In a muscular limb it forms a triangular depression, bounded internally by the *pronator radii teres*, externally by the *supinator longus*, and above by the projection of the *brachialis anticus* and biceps. The tendon of the biceps can here be felt, with the brachial artery on its inner side; more internally is the median nerve.

In front of the artery, separated from it by the bicipital or semilunar fascia, is the *median basilic vein*, running upwards and inwards, and accompanied by the anterior branches of the internal cutaneous nerve. Externally is the *median cephalic vein*, somewhat smaller, running upwards and outwards, accompanied by the anterior branches of the musculo-cutaneous or external cutaneous nerve. The *musculo-spiral nerve* is deeply situated behind the musculo-cutaneous, between the brachialis anticus and the supinator longus. At the apex of the triangle is the termination of the *median vein.*

The circulation in the brachial artery may be completely arrested by forcible flexion of the forearm upon the arm.

Skeleton of the Elbow.— **Internal condyle** more prominent than the external, and situated a little higher; **external condyle** less prominent than the internal, and situated a little lower.

Olecranon lies nearer to the inner than to the outer condyle. Between it and the inner condyle is a groove ("funny bone") containing the ulnar nerve and the posterior ulnar recurrent artery.

In extension the *top of the olecranon* is in the horizontal line of the condyles; in the intermediate position it lies below and behind them; in complete flexion, below and in front. There is a bursa over it (miner's bursa).

The **head of the radius** lies just below the external condyle, beneath a little pit or dimple of the skin. It can easily be felt when the forearm is rotated.

A Lymphatic Gland lies just above and in front of the internal condyle.

Ulna.—The **shaft** can be traced along its whole length, its posterior border being everywhere subcutaneous.

The **head** forms a distinct rounded prominence at the back of the wrist, especially evident in pronation.

The **styloid process** lies farther back than that of the radius, and does not descend so low; its apex marks the level of the radio-carpal joint. Between it and the back of the head is the groove for the *extensor carpi ulnaris.*

Radius.—Only the lower half of its shaft can well be felt, the upper half being covered by muscles. Its lower expanded extremity presents externally the **styloid process,** which is situated further forwards and descends lower down than that of the ulna; and then, from without inwards, the following **tendinous grooves,** each lined by a synovial sheath:—

1. Broad and shallow groove, divided in two by a slight ridge, for *extensores ossis metacarpi* and *primi internodii pollicis;*

2. Broad and shallow groove, similarly divided, for *extensores carpi radialis longior* and *brevior;*
3. Narrow and deep groove, for *extensor secundi internodii pollicis;*
4. Broad and shallow groove, for *extensores indicis* and *communis digitorum;*
5. Half groove, completed internally by head of ulna, for *extensor minimi digiti.*

Back and Outer Side of the Wrist.—The above-mentioned extensor tendons are distinctly visible when the muscles are brought into action. The corresponding synovial sheaths extend from a little above the posterior annular ligament almost to the phalangeal insertions.

"Anatomical Snuff-box."—Comprised between the *extensores ossis metacarpi* and *primi internodii pollicis*, on the one hand, and the *extensor secundi internodii* on the other, and deeply hollowed out when the thumb is forcibly extended. Over it runs the radial vein. The *radial artery* crosses it deeply, running along a line drawn from the apex of the styloid process of the radius to the uppermost part of the first interosseous space. Towards its middle can be felt the projection of the upper end of the metacarpal bone of the thumb.

Carpus.—The *tubercle of the scaphoid* can be felt below and in front of the styloid process of the radius. Below it can be felt the *trapezium*, though less distinctly, as it is covered by the muscles of the thenar eminence. Below, and a good way in front of the styloid process of the ulna, is the rounded prominence of the *pisiform bone.* Below this is the indistinctly felt prominence of the *unciform process* of the unciform bone. The *cuneiform* bone can be distinctly felt at the back of the carpus, a little below the head of the ulna.

Joints of the Fingers.—Notice on the skeleton that, in the extended position, the metacarpal bones and phalanges are placed end to end, and that, in the flexed position, the distal bone is found in front of the proximal one. The line of articulation lies, therefore, in the flexed

position of a joint, at a distance from the corresponding knuckle (or projection of the proximal bone behind) equal to thickness from before backwards of the distal extremity of the proximal bone.*

The position of the *joint of the metacarpal bone of the thumb* is indicated by the above-mentioned projection of the metacarpal bone at the bottom of the "anatomical snuff-box."

Radial Artery.—Runs along a line drawn from *midway between condyles of humerus* to a point *just internal to the styloid process of the radius*. In the upper third of its course it is covered by the *supinator longus*. Lower down it lies in the groove between the tendon of that muscle and that of the *flexor carpi radialis*. The *radial nerve* lies close to the outer side of the artery in the middle third of the forearm, but is distant from it both above and below. At the wrist the radial artery gives off the *superficialis volæ*, which crosses the thenar eminence, and sometimes pulsates distinctly.

Ulnar Artery.—Runs deeply at first from the bend of the elbow to near the middle of the inner border of the forearm. It then descends more superficially between the *flexor carpi ulnaris* and the *flexor sublimis digitorum*. Here it runs along a line drawn from *the inner condyle*, or a point *a little external to it*, to a point *a little external to the pisiform bone*. The *ulnar nerve* lies close to the inner side of the artery in the lower two-thirds of its course.

Superficial Palmar Arch.—Crosses palm of hand about junction of middle and upper thirds, opposite lower border of abducted thumb. **Deep palmar arch** lies half an inch higher up. The *superficial palmar interosseous* (or digital) *arteries* run *towards the clefts* between the fingers, and lie, therefore, *between* the shafts of the metacarpal bones. Incisions in the palm below the line of the thumb should be made towards the fingers—that is to say, *over* the metacarpal bones. Upon the fingers, the digital arteries run along the sides of the sheaths behind the corresponding nerves. Incisions to open thecal abscesses should be made over the middle line of the finger.

* This fact will prove, it is believed, the surest guide to the situation of the joints of the fingers. The flexion lines on the palmar aspect of the fingers are all wrong as guides to the joints, except the second one from the tip of the finger. The first one from the tip is much above, and the third one much below, the corresponding joint.

Front of the Wrist.—Shows, in forcible flexion, the tendons of the *flexor carpi radialis* and *palmaris longus*. The *median nerve* lies close to the inner border of the former. (The palmaris longus is sometimes absent.)

The *lower of the transverse furrows* here visible corresponds to the upper edge of the anterior annular ligament, and to the medio-carpal joint.

The synovial sheath common to the *flexores sublimis* and *profundus*, and that of the *flexor longus pollicis*, rise an inch and a half above the upper edge of the anterior annular ligament. Inferiorly these sheaths communicate with the special sheaths of the thumb and little finger, but not with those of the index, middle, and ring fingers, ending, as regards these fingers, about the middle of the palm.

Transverse Furrows in the Palm.—The lowest one, which crosses the palm about its lower third, marks the upper limit of the synovial sheaths of the index, middle, and ring fingers, and the division of the superficial palmar interosseous arteries into the digital proper. The other furrows are unimportant.

Back of the Hand.—Here again the *dorsal interosseous arteries* run upon the interosseous spaces, and incisions should be made towards the fingers, or *over* the metacarpal bones.

(See practical questions at end of book.)

LOWER LIMB.

I.

FRONT & INNER SIDE OF THIGH.

MUSCLES of LOWER LIMB—1st Tablet.

ILIAC REGION.

Psoas Magnus – Bases of transverse processes of lumbar vertebræ, and by five slips from sides of bodies of lumbar & last dorsal vertebræ & from corresponding intervertebral substances; the slips being connected by tendinous arches which extend across the constricted part of the bodies of the vertebræ.

Lesser trochanter of femur. – S. by anterior branches of lumbar nerves.

Psoas Parvus – Sides of bodies of last dorsal & first lumbar vertebræ & corresponding intervertebral substance.

Ilio-pectineal eminence. – S. by anterior branches of lumbar nerves. – Is frequently absent.

Iliacus – Iliac fossa & inner lip of crest of ilium; ilio-lumbar ligament; base of sacrum; anterior superior & anterior inferior spines of ilium & notch between them; capsule of hip-joint.

Outer side of tendon of psoas, and upper part of line from lesser trochanter to linea aspera in front of pectineus. – S. by anterior crural nerve.

ANTERIOR FEMORAL REGION.

Tensor Vaginæ Femoris – Anterior superior spinous process and anterior part of outer lip of crest of ilium.

Fascia lata about ½ down outer side of thigh. – S. by superior gluteal nerve.

Sartorius – Anterior superior spinous process of ilium & upper half of notch below it.

Upper part of inner surface of shaft of tibia covering tendons of gracilis & semitendinosus. – S. by middle or internal cutaneous branch of anterior crural nerve.

Rectus Femoris – Anterior inferior spinous process of ilium (straight tendon); groove above brim of acetabulum (reflected tendon).

Upper border of patella in common with vasti & crureus. – S. by anterior crural nerve.

Vastus Externus – Anterior border of great trochanter & horizontal ridge on its outer surface; rough line from great trochanter to linea aspera; whole length of outer lip of linea aspera & line from linea aspera to outer condyle; external intermuscular septum.

Outer border of patella & slightly into head of tibia. – S. by anterior crural nerve.

Vastus Internus – Line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; inner surface of femur; internal intermuscular septum.

Inner border of patella & slightly into head of tibia. – S. by anterior crural nerve.

Crureus – Anterior & outer surfaces of femur reaching from anterior intertrochanteric line to within a few inches of condyles.

Upper border of patella in common with rectus & vasti. – S. by anterior crural nerve.

Taking the vastus internus & the crureus as forming but one muscle, and describing the *Quadriceps extensor femoris* as a *Triceps*, we may say that the "VASTUS INTERNUS" arises from: – line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; nearly whole of *inner, anterior* and *outer* surfaces of shaft of femur; internal intermuscular septum; – and that it is inserted into tendon of rectus & borders of patella, and slightly into head of tibia.

Subcrureus – Lower part of anterior surface of femur.

Upper part of synovial membrane of knee-joint. – S. by anterior crural nerve.

FIG. 218.—MUSCLES OF FRONT OF THIGH: SUPERFICIAL VIEW. (Gray.)

FIG. 219.—MUSCLES OF FRONT OF THIGH: DEEP VIEW. (Quain.)

In Fig. 219, 3, origin of rectus; 6, pectineus; 7, adductor brevis; 9, vastus internus; 11, vastus externus.

In Fig. 220, 2, obturator internus; 5, 5′, 5″, 5‴, adductor magnus; 8, short head of biceps.

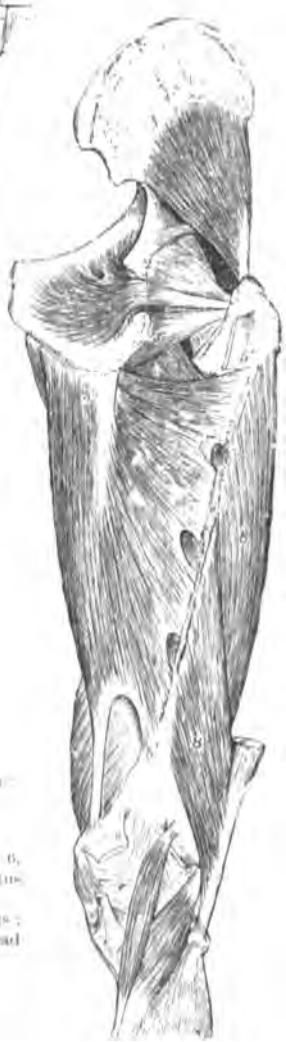


FIG. 220.—MUSCLES OF BACK OF THIGH: DEEP VIEW. (Quain.)

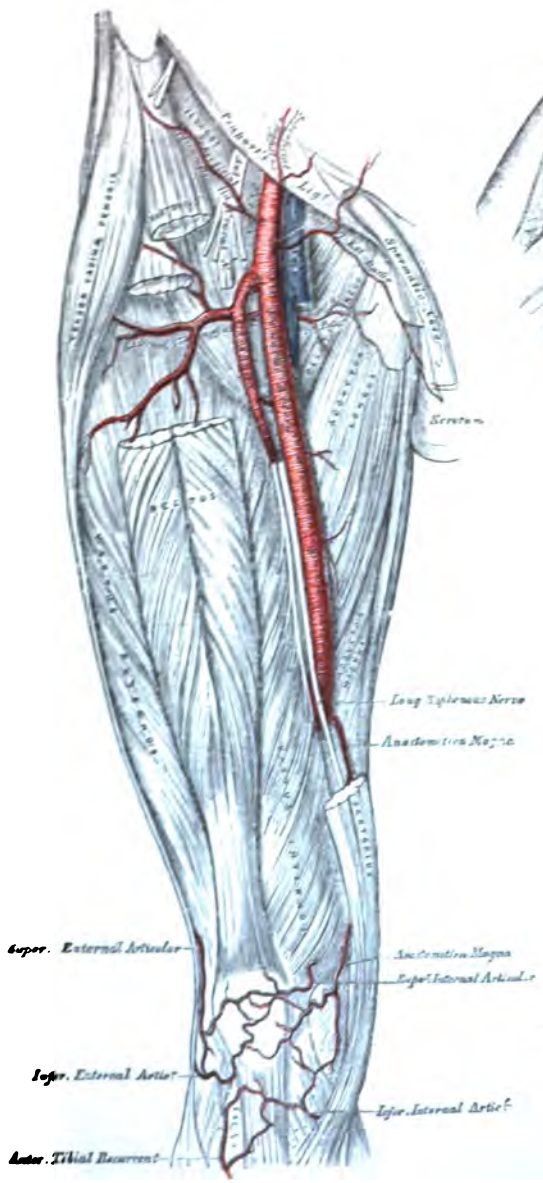


FIG. 221.—THE FEMORAL ARTERY. (Gray.)

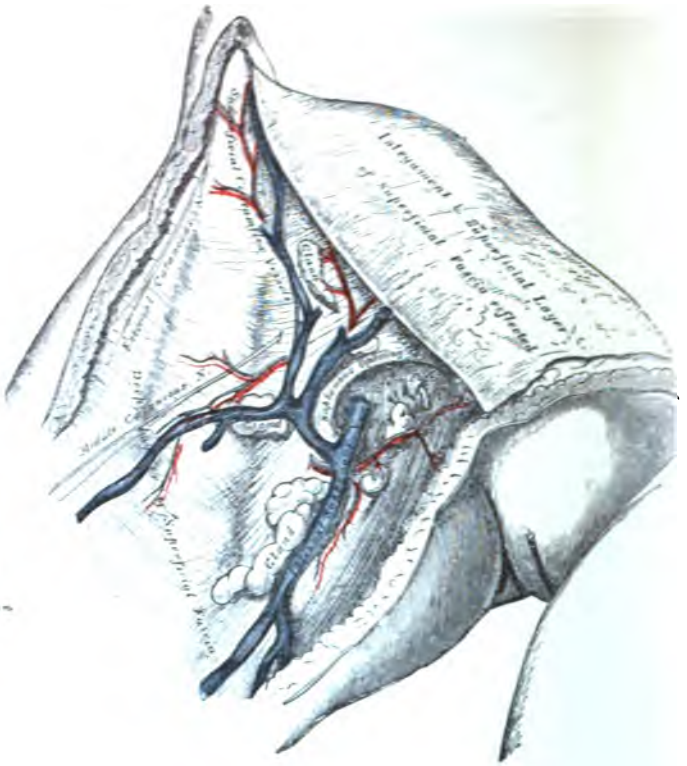


FIG. 222.—ITS SUPERFICIAL BRANCHES AND THE CORRESPONDING VEINS. (Gray.)

FEMORAL ARTERY

Commences beneath Poupart's ligament midway between antero-superior spine of ilium & symphysis pubis, and a little to inner side of head of femur.

Passes down front & inner side of thigh, being at first at a distance from, and then close to, the shaft of the bone.

Terminates at junction of middle and lower thirds of thigh, becoming popliteal artery in opening in lower part of adductor magnus. – Some Authors describe a *common* femoral artery descending as low down as the origin of the *deep* femoral, the main trunk below this branch being called the *superficial* femoral.

Its direction is marked by a line drawn from midway between antero-superior spine of ilium and symphysis pubis to inner side of inner condyle of femur.

RELATIONS — Must be examined in Scarpa's triangle, or in upper third, and in middle third of thigh.

IN SCARPA'S TRIANGLE — The artery divides the triangle into two nearly equal parts, and has

In Front – Skin, superficial fascia, fascia lata (except opposite saphenous opening, where latter is replaced by cribriform fascia), sheath; internal cutaneous nerve & filaments of crural branch of genito-crural n.; inguinal lymphatic glands.

Behind – Posterior part of sheath; psoas, pectineus, adductor longus; profunda artery & vein.

On Inner Side at Upper Part – Femoral vein, which becomes posterior below.

On Outer Side – Psoas muscle, anterior crural & long saphenous nerves.

IN MIDDLE THIRD OF THIGH — It lies behind sartorius in Hunter's canal, –a deep depression between vastus internus & tendons of adductors longus & magnus closed in anteriorly by a band of fascia,–and has femoral vein behind it & to its outer side, and long saphenous nerve to its outer side & in front.

BRANCHES:

Superficial Epigastric — Arises close to Poupart's ligament. Through saphenous opening, and then upwards and inwards in superficial fascia of abdomen, and anastomoses with deep epigastric & internal mammary.

Superficial Circumflex iliac — Arises close to Poupart's ligament. Pierces fascia lata on outer side of saphenous opening, and upwards & outwards below Poupart's ligament to crest of ilium. Anastomoses with circumflex iliac & gluteal arteries.

Superficial or Sup. External Pudic — Arises near preceding. Inwards through saphenous opening, and then across spermatic cord or round ligament to integument of abdomen, penis & scrotum, or labia.

Deep or Inf. External Pudic — Arises with or near preceding. Inwards beneath fascia lata, which it pierces opposite pubes, to integument of perinæum & to scrotum or labia.

Profunda Femoris, or Deep Femoral — Vide p. 67.

Muscular Brs. — Numerous, and given off along entire course.

Anastomotica magna — Arises in Hunter's canal. Descends upon tendon of adductor magnus, and divides into:

Superficial Branch – With internal saphenous nerve to integument of inner side of knee.

Deep Branch – Through substance of vastus internus to inner side of front of knee, and anastomoses with superior internal & superior external articular arteries & with recurrent branch of tibial.

COLLATERAL CIRCULAT. — Is reestablished after ligature of the common femoral through the gluteal, ilio-lumbar & circumflex iliac arteries, which join with the external circumflex, through the obturator & sciatic, which join with the internal circumflex, through the comes nervi ischiadici, which join the terminal & perforating branches of the profunda. – After ligatu superficial femoral it is reestablished mainly through the deep f its perforating branches, which join with the articular branches of t

The veins of cancer (Surgery of cancer in Surgery / Vein to remove)

INTERNAL or LONG SAPHENOUS VEIN — Commences at inner side of arch on dorsum of foot. Accompanies long or internal saphenous nerve in front of internal malleolus, along inner side of leg, & behind inner condyle; it then inclines forwards along inner aspect of thigh, and, passing through saphenous opening, terminates in the femoral about an inch & a half below Poupart's ligament. It receives numerous cutaneous branches from leg & thigh, (the branches from inner aspect of thigh frequently uniting into one large trunk); and it also receives near its termination, the superficial epigastric, superficial circumflex iliac & superficial external pudic. It communicates with the internal plantar, anterior & posterior tibial, & femoral, and contains from two to six valves, which valves are usually more numerous in the thigh than in the leg.

ANTERIOR CRURAL NERVE.

The largest branch of lumbar plexus. — Arises mainly from 3rd & 4th lumbar nerves, but receives also a fasciculus from the 2nd.
Descends through substance of psoas, and emerges from lower part of its outer border.
Passes down between psoas & iliacus, giving off small branches to iliacus & femoral artery.
Enters thigh beneath Poupart's ligament half an inch to outer side of femoral artery, and divides into anterior & posterior divisions.

ANTERIOR DIVISION – Gives off:

Middle Cutaneous Nerve – Pierces fascia lata & generally sartorius also (which muscle it then supplies) about *three or four inches below Poupart's ligament*, and divides into two branches to integument of front of thigh as low as knee. – Joins with crural branch of genito-crural, internal cutaneous & internal saphenous.

Internal Cutaneous Nerve – Crosses upper part of sheath of femoral vessels giving off a few cutaneous filaments, and divides into:

ANTERIOR OR EXTERNAL BRANCH – Pierces fascia lata about *lower third of thigh*, and divides into branches to integument of inner & outer sides of knee; joins with middle cutaneous & long saphenous.

INNER OR POSTERIOR BRANCH – Along posterior border of sartorius, joining in a plexiform network beneath fascia with long saphenous & obturator. Pierces fascia lata *a little above inner side of knee*; supplies integument of inner sides of thigh & upper part of leg, joining with int. saphenous.

Long or Internal Saphenous Nerve – The largest branch of anterior division (arises sometimes from posterior division).

Along whole length of outer side of femoral artery, lying first at a slight distance from it, and then close to it.
Pierces fibrous band which extends from vastus internus to tendons of adductors longus & magnus and forms anterior wall of Hunter's canal.
Pierces deep fascia *between tendons of sartorius & gracilis*, and joins with internal cutaneous.
Passes with internal saphenous vein along inner side of leg & divides into two branches; one terminates at inner ankle, the other passes in front of ankle to integument of inner side of foot.
Joins in plexiform network above mentioned with internal cutaneous & obturator nerves; – gives off to integument of front of knee a large branch, nervus cutaneus patellæ, which, joining with external, middle & internal cutaneous nerves & other branches of long saphenous, forms plexus patellæ in front of knee; – gives off numerous branches to integument of front & inner side of leg.

POSTERIOR DIVISION – Gives off:

Muscular Branches

To all the muscles of front of thigh except tensor vaginæ femoris supplied by superior gluteal n., and Sartorius supplied by filaments from middle or sometimes from internal cutaneous nerve. [pectineus is partly supplied by obturator nerve]

Articular Branches

Two; – one from nerve to vastus externus, long & slender & distributed to front of capsule; one from nerve to vastus internus, accompanies deep branch of anastomotica magna to inner side of capsule.

MUSCLES of LOWER LIMB—2nd Tablet.

INTERNAL FEMORAL REGION.

Pectineus – Ilio-pectineal line & surface in front of it.

Upper part of line from trochanter minor to linea aspera, & into femur behind trochanter minor. – S. by obturator or anterior crural nerve; – by accessory obturator nerve when the latter exists.

Gracilis – Inner margin of rami of pubes & ischium & lower half of inner margin of body of pubes.

Upper part of inner surface of shaft of tibia above semitendinosus, and beneath sartorius. – S. by obturator nerve.

Adductor Longus – Front of pubes immediately below the crest & close to angle.

Middle third of inner lip of linea aspera between vastus internus & adductor magnus. – S. by obturator nerve.

Adductor Brevis – Front of pubes for about two inches below adductor longus & between gracilis & obturator externus.

Upper part of linea aspera & lower part of line from it to lesser trochanter below & behind pectineus. – S. by obturator nerve or anterior crural nerve.

Adductor Magnus – Lower part of descending ramus of pubes; ascending ramus & outer side of tuberosity of ischium.

Lower part of line from great trochanter to linea aspera, whole length of inner lip of linea aspera & line from it to inner condyle; by a strong tendon into tubercle at upper & back part of inner condyle. – S. by obturator & great sciatic nerves.

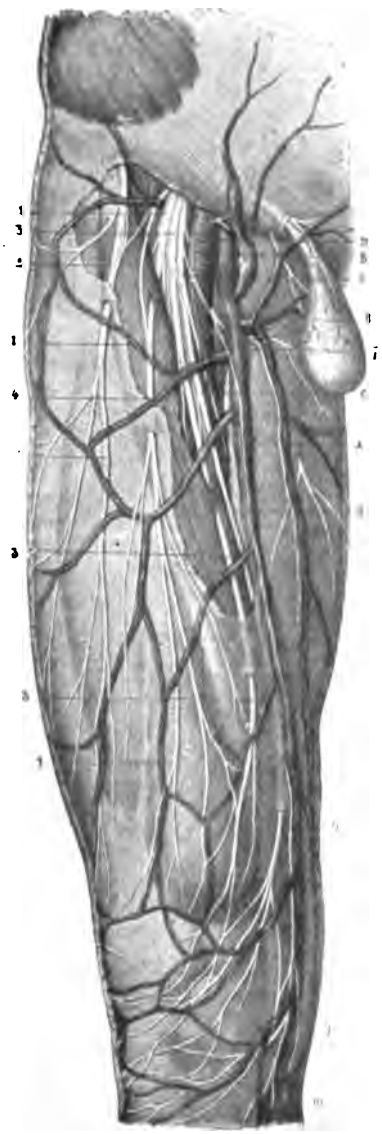


FIG. 223.—CUTANEOUS NERVES OF FRONT & INNER SIDE OF THIGH. (Hirschfeld.)

1, 1, middle cutaneous nerve; 3, 3, external branch of internal cutaneous nerve; 5, its internal branch.

(See expl., p. 96g.)

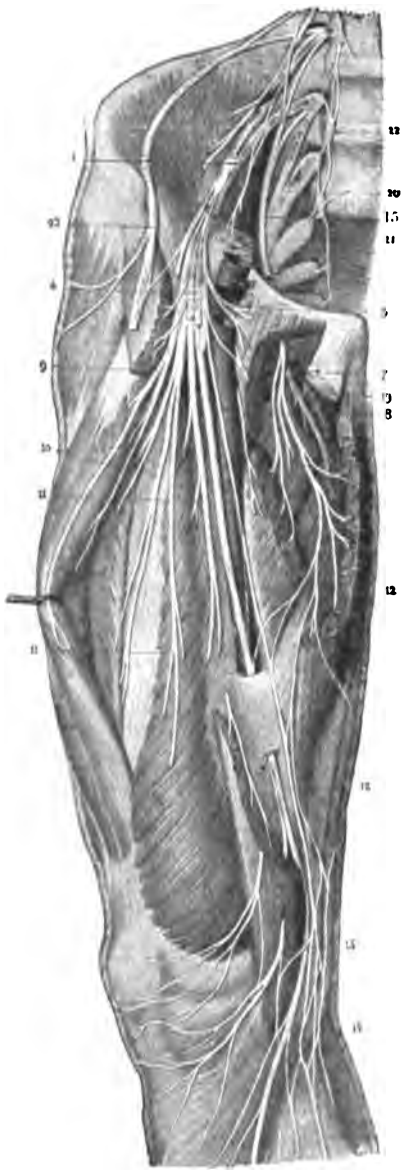


FIG. 224. DEEP NERVES OF FRONT & INNER SIDE OF THIGH. (Hirschfeld.)

1, anterior crural nerve; 4, middle cutaneous, and greater part of internal cutaneous nerves, divided; 8, internal branch of the latter, joining with obturator nerve; 12, internal saphenous nerve; 15, obturator nerve; 23, external cutaneous nerve of lumbar plexus.

(See expl., p. 96g.)

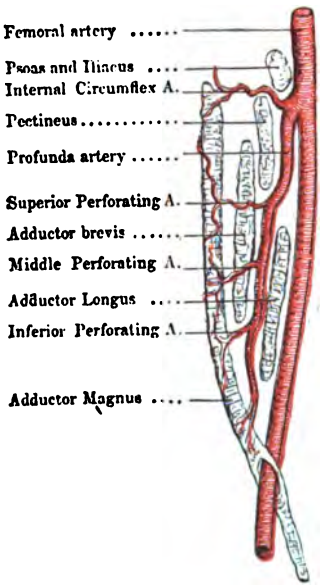


FIG. 225.—DIAGRAM OF THE PROFUNDA FEMORIS ARTERY. (Heath.)

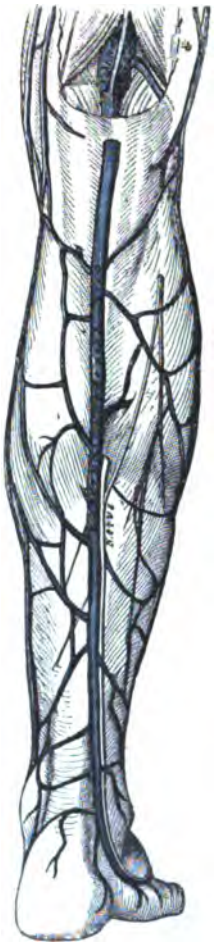


FIG. 226.—THE EXTERNAL, OR SHORT SAPHENOUS VEIN. (Gray.)

FIG. 227.—THE INTERNAL, OR LONG SAPHENOUS VEIN. (Gray.)

DEEP FEMORAL ARTERY

From outer & back part of femoral one or two inches below Poupart's ligament, and nearly equals superficial femoral in size.

Passes: –

Downwards & outwards in front of iliacus, on outer side of femoral artery;
Downwards & inwards behind femoral vessels & profunda vein, and in front of pectineus;

Backwards between pectineus & adductor longus;
Downwards behind adductor longus, in front of adductors brevis & magnus; –
and ends in a small branch, which perforates lower part of adductor magnus to muscles of back of thigh, and anastomoses with inferior perforating & with branches of popliteal.

BRANCHES:

EXTERNAL CIRCUMFLEX — The larger. From outer side of artery close to its origin.

Outwards between branches of anterior crural nerve and beneath sartorius & rectus, and divides into branches:

ASCENDING – Beneath tensor vaginæ femoris, and anastomose with gluteal & circumflex iliac.

DESCENDING – Usually three or four & of considerable size. – Beneath rectus muscle to vasti, principally the external. One large branch descends with nerve to vastus externus as low as knee, and anastomoses with articular branches of popliteal.

TRANSVERSE – Smaller. Wind round femur below trochanter major in substance of vastus externus, and anastomose with internal circumflex, sciatic & superior perforating.

INTERNAL CIRCUMFLEX — The smaller. From inner & back part close to origin.

Backwards between pectineus & psoas, and winds round inner side of neck of femur to interval between quadratus femoris and adductor magnus, and anastomoses with external circumflex, sciatic & superior perforating. Gives off branches:

ASCENDING – To adductor muscles, gracilis & obturator externus; anastomoses with obturator.

DESCENDING – Between adductors brevis & magnus, which it supplies.

ARTICULAR – Into acetabulum through notch beneath transverse ligament; supplies adipose tissue, and sends twigs along round ligament to head of femur.

PERFORATING — Usually three & of good size. – Arise behind adductor longus, above, in front of, and below, adductor brevis, and pass to back of thigh, the

SUPERIOR, — Perforating the adductor magnus above the brevis (some-perforating adductor brevis also);

MIDDLE, — Perforating both these adductors;

INFERIOR, — Perforating the adductor magnus below the brevis;

and supply hamstring muscles & anastomose with each other, sciatic, internal circumflex & termination of profunda, the middle one, the largest, giving off ascending & descending branches, and nutrient artery of femur.

OBTURATOR NERVE.

Arises mainly from 3rd & 4th lumbar nerves, but receives also a fasciculus from the 2nd (Sappey, Hirschfeldt, & Quain's diagram of lumbar plexus).
Descends through inner fibres of psoas, and emerges from inner border of that muscle opposite brim of pelvis.
Along outer wall of pelvis above obturator vessels to upper part of obturator foramen; enters thigh, and divides into:

Anterior Branch – The smaller. Descends in front of adductor brevis, and behind pectineus & adductor longus, to femoral artery, upon which it is distributed below the latter muscle. Gives off branches: –

ARTICULAR – To hip-joint; arises near obturator foramen.
MUSCULAR – To gracilis & adductor longus, and sometimes to pectineus & adductor brevis;
ANASTOMOTIC TO INTERNAL CUTANEOUS & INTERNAL SAPHENOUS NERVES – Arises opposite lower border of adductor longus, and forms with the foregoing nerves a plexiform network beneath deep fascia of thigh.
Sometimes this anterior branch of the obturator nerve, and its communicating offset to the internal cutaneous & internal saphenous nerves, are larger than usual. The latter then gives off cutaneous filaments to the skin of the lower & inner part of the thigh, and descends along the posterior border of the sartorius to the inner side of the knee-joint; here it pierces the deep fascia, communicates again with the internal saphenous nerve (which is then smaller than usual), and supplies the skin of the inner side of the leg as low as its middle.

Posterior Branch – The larger. Pierces upper fibres of obturator externus, and descends behind adductor brevis in front of adductor magnus; gives off branches: –

MUSCULAR – To obturator externus & adductor magnus (and to adductor brevis, when the latter is not supplied by the anterior branch of the nerve).
ARTICULAR – Through opening in lower part of adductor magnus, and upon the popliteal artery to back of knee-joint.

ACCESSORY OBTURATOR NERVE

Arises (when it exists) either directly from obturator nerve, or, by separate filaments, from the 2nd, 3rd, & 4th lumbar.
Descends along inner side of psoas, crosses front of pubes, gets behind pectineus, and divides into branches to pectineus & hip-joint. Communicates with anterior branch of obturator nerve; the communicating branch is sometimes large, and is then prolonged as a cutaneous nerve to the thigh & leg (Gray)

LOWER LIMB.

II.

FRONT OF LEG & DORSUM OF FOOT.

MUSCLES of LOWER LIMB—3rd Tablet.

ANTERIOR TIBIO-FIBULAR REGION.

Tibialis Anticus – Outer tuberosity & upper two-thirds of outer surface of shaft of tibia; adjoining part of the interosseous membrane; intermuscular septum between it & extensor longus digitorum; deep fascia.

Inner & under surfaces of internal cuneiform bone & base of first metatarsal. – S. by anterior tibial nerve.

Extensor Longus Digitorum – Outer tuberosity of tibia; upper three-fourths of anterior surface of shaft of fibula; interosseous membrane; septa between it and tibialis anticus & peronei muscles; deep fascia.

Bases of 2nd & 3rd phalanges of four outer toes. – S. by anterior tibial nerve.

Extensor Proprius Pollicis – Middle two-fourths of anterior surface of shaft of fibula internally to extensor longus digitorum; interosseous membrane.

Base of last phalanx of great toe. – S. by anterior tibial nerve.

Peroneus Tertius – Lower fourth of anterior surface of shaft of fibula; lower part of interosseous membrane; intermuscular septum between it & peroneus brevis.

Base of 5th metatarsal bone. – S. by anterior tibial nerve.

FIBULAR REGION.

Peroneus Longus – Head & upper two-thirds of outer surface & of anterior & posterior borders of fibula; intermuscular septa between it & muscles of front & back of leg; deep fascia.

Outer side of base of first metatarsal bone. – S. by musculo-cutaneous branch of external popliteal nerve.

Peroneus Brevis – Lower two-thirds of outer surface of shaft of fibula, passing upwards in a pointed process beneath peroneus longus; intermuscular septa between it & muscles of front & back of leg.

Base of fifth metatarsal bone. – S. by musculo-cutaneous branch of external popliteal nerve.

MUSCLES of the FOOT.

DORSAL REGION.

Extensor Brevis Digitorum – Outer & upper surfaces of greater process of os calcis, calcaneo-astragaloid ligament, anterior annular ligament of tarsus.

First phalanx of great toe & outer sides of long extensor tendons of 2nd, 3rd, & 4th toes. – S. by external branch of anterior tibial nerve.

FIG. 228.—MUSCLES OF THE FRONT OF THE LEG. (Gray.)

FIG. 229.—THE ANTERIOR TIBIAL AND DORSALIS PEDIS ARTERIES. (Gray.)

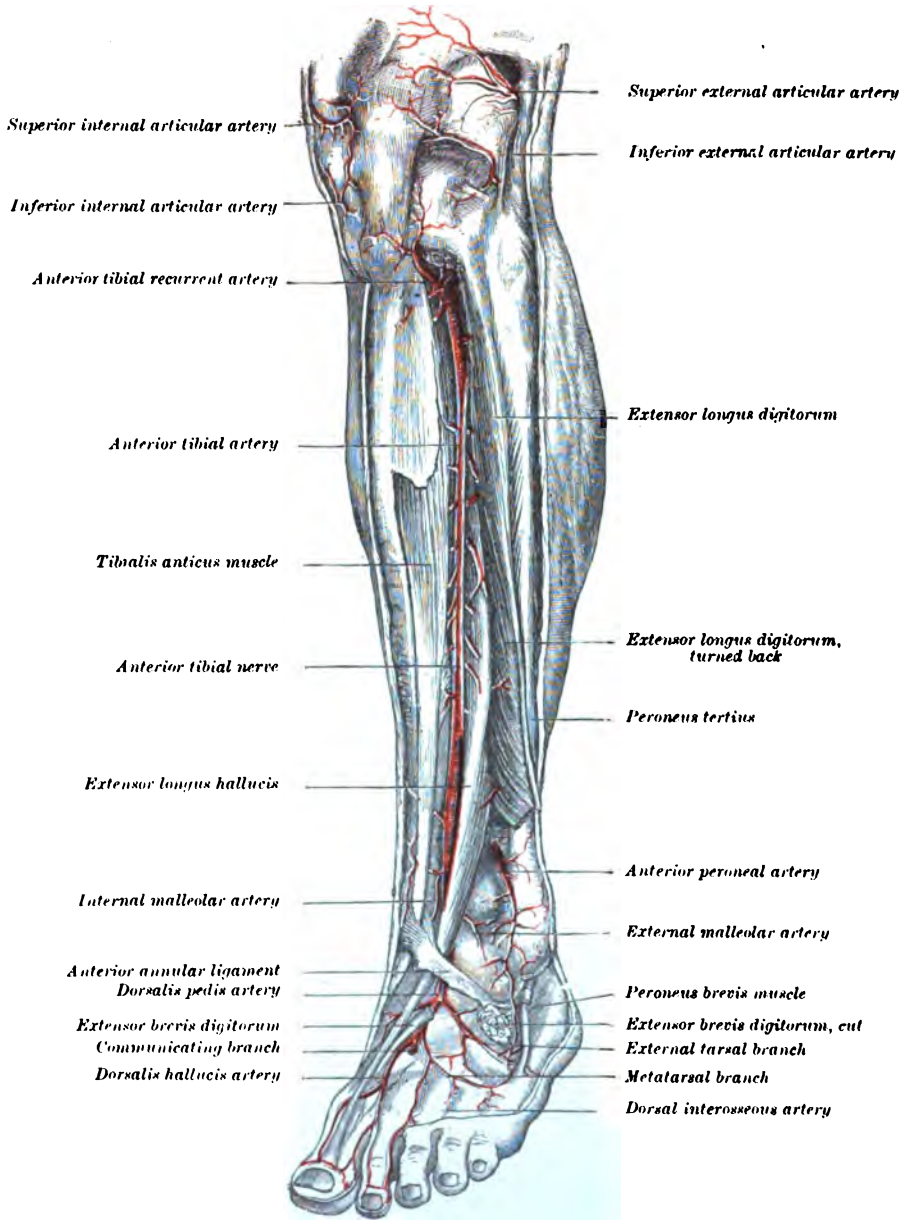


FIG. 230.—THE ANTERIOR TIBIAL AND DORSALIS PEDIS ARTERIES. (Morris.)

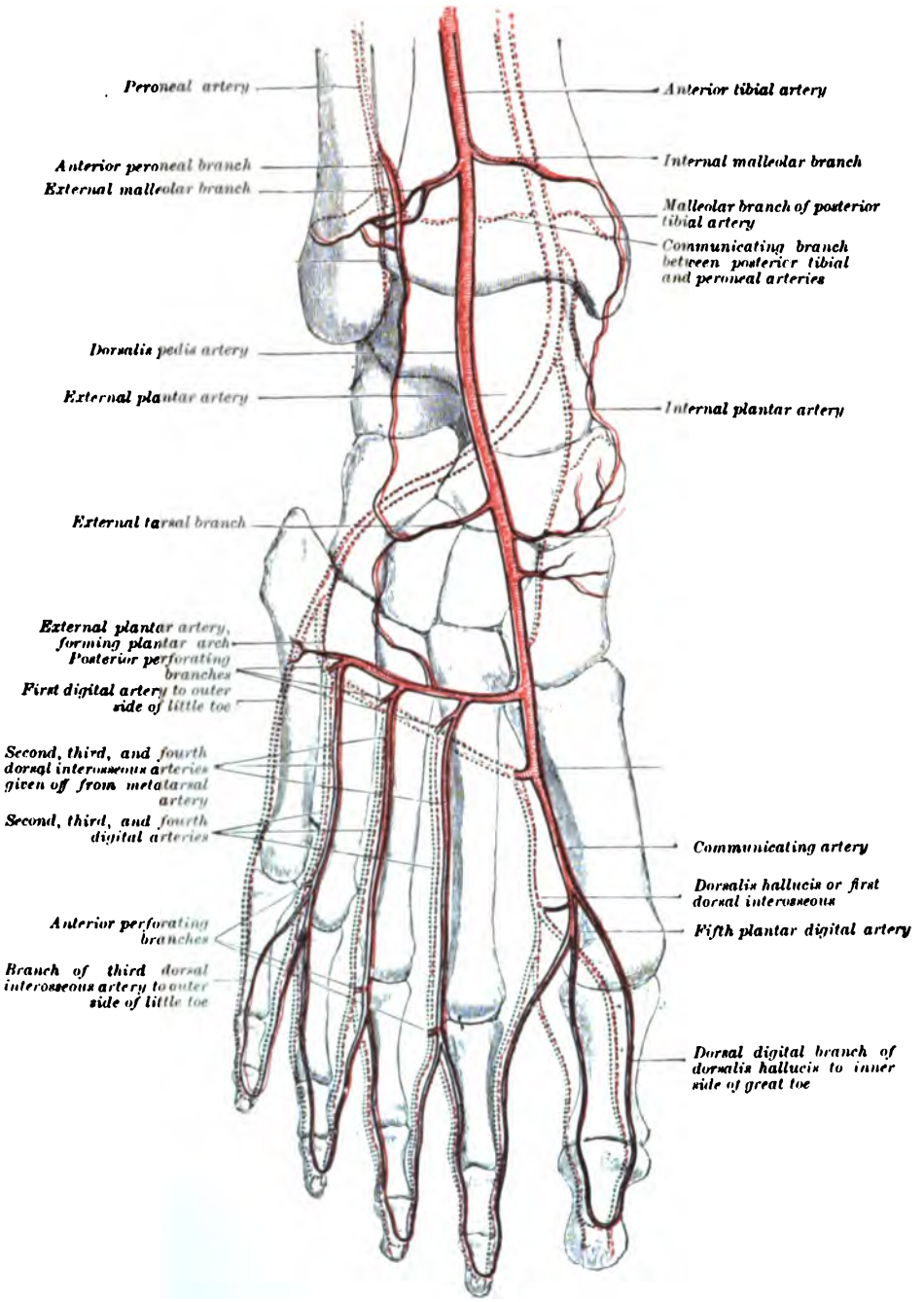

Peroneal artery
Anterior tibial artery
Anterior peroneal branch
External malleolar branch
Internal malleolar branch
Malleolar branch of posterior tibial artery
Communicating branch between posterior tibial and peroneal arteries
Dorsalis pedis artery
External plantar artery
Internal plantar artery
External tarsal branch
External plantar artery, forming plantar arch
Posterior perforating branches
First digital artery to outer side of little toe
Second, third, and fourth dorsal interosseous arteries given off from metatarsal artery
Second, third, and fourth digital arteries
Communicating artery
Dorsalis hallucis or first dorsal interosseous
Fifth plantar digital artery
Anterior perforating branches
Branch of third dorsal interosseous artery to outer side of little toe
Dorsal digital branch of dorsalis hallucis to inner side of great toe

FIG. 231.—DIAGRAM OF THE ARTERIES OF THE FOOT. (Morris.)

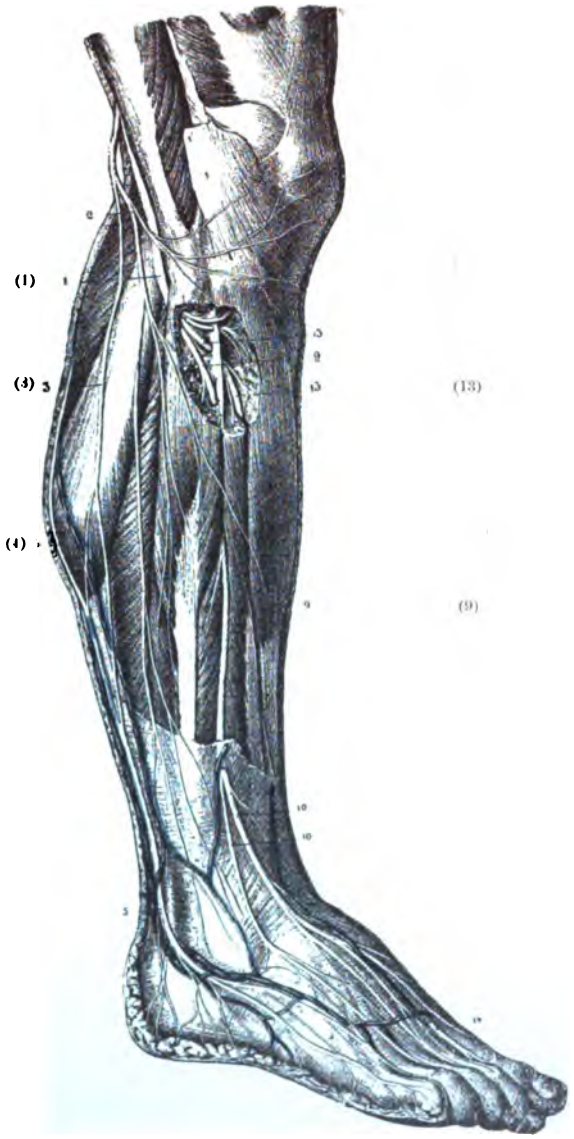


FIG. 232.—DISTRIBUTION OF EXTERNAL POPLITEAL NERVE: SUPERFICIAL DISSECTION.

1, external popliteal nerve; 3, communicans fibularis; 4, communicans tibialis; 5, external saphenous nerve; 9, musculocutaneous nerve; 13, anterior tibial nerve. (See expl., p. 174.)

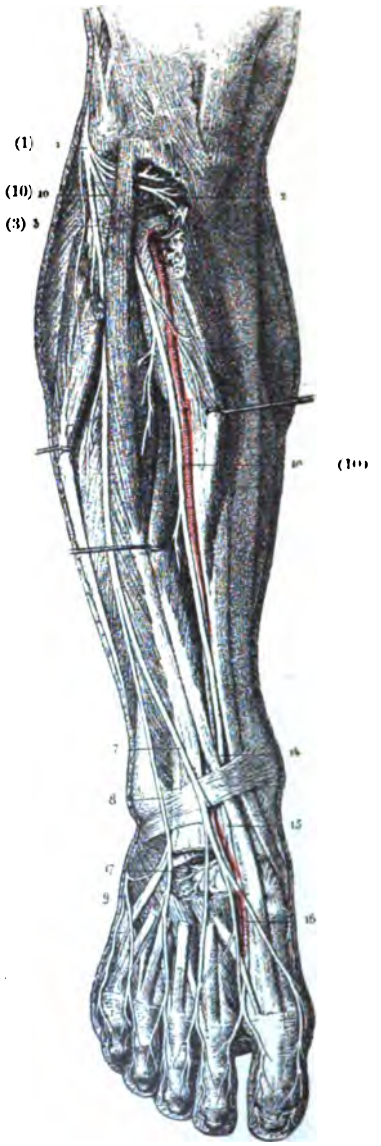


FIG. 233.—DISTRIBUTION OF THE EXTERNAL POPLITEAL NERVE: DEEP DISSECTION.

1, external popliteal nerve; 3, musculocutaneous nerve; 10, anterior tibial nerve. (See expl., p. 167.)

ANTERIOR TIBIAL ARTERY

Anterior & smaller branch of bifurcation of popliteal opposite lower border of popliteus muscle.

Forwards between the two heads of tibialis posticus, and between tibia & fibula through opening in upper part of interosseous ligament.

Downwards in front of interosseous ligament, shaft of tibia & ankle joint (where becomes dorsalis pedis), passing between tibialis anticus & extensor longus digitorum, between tibialis anticus & extensor proprius pollicis, between tendon of extensor proprius pollicis, which crosses it, and innermost tendon of extensor longus digitorum; – lying in a line from inner side of head of fibula to midway between malleoli, and being deeply situated, above, between muscles on either side & beneath tendon of extensor proprius pollicis, and superficially, below, beneath skin, anterior annular ligament & fascia.

Has two venæ comites. Anterior tibial nerve is first external, then anterior, then again external to it.

BRANCHES:

Recurrent tibial — Arises in upper part of leg. Upwards through tibialis anticus to front of knee, and anastomoses with inf. articular branches of popliteal.

Muscular — Numerous small branches to muscles on either side.

Malleolar — Two; rather variable in size. Arise near ankle, and pass, the

INTERNAL, – To inner ankle beneath tendons of extensor proprius pollicis & tibialis anticus,

EXTERNAL, – To outer ankle beneath extensor longus digitorum,

and anastomose respectively with posterior tibial & internal plantar, and with tarsal & peroneal.

DORSALIS PEDIS ARTERY

From bend of ankle to back of first interosseous space, resting upon bones of tarsus between tendon of extensor proprius pollicis & innermost tendon of extensor brevis digitorum, which crosses it near termination, and having anterior tibial nerve on its outer side.

BRANCHES:

Tarsal — Arches outwards beneath extensor brevis digitorum, and anastomoses with metatarsal, external malleolar & external plantar.

Metatarsal — More or less obliquely forwards in front of preceding. Gives off the THREE OUTER DORSAL INTEROSSEOUS ARTERIES – Along corresponding interosseous spaces. Are joined by anterior & posterior perforating branches, and supply dorsal digital branches to 3½ toes on outer side of foot.

Dorsal Art. of Great Toe — Is the first dorsal interosseous artery, and supplies dorsal digital branches to 1½ toes on inner side of foot.

Communicating — Between the two heads of first dorsal interosseous muscle, and inosculates with external plantar, completing plantar arch. Gives off plantar digital branches to 1½ toes on inner side of foot.

EXTERNAL POPLITEAL NERVE.

Funny nerve of leg - easily hit as it lies over head of Fibula.

The smaller of the two terminal branches of great sciatic.
Along outer side of popliteal space close to biceps.
Pierces peroneus longus an inch below head of fibula, and divides into anterior tibial & musculo-cutaneous. Gives off branches: -

Articular – Three; accompany the two external articular & the recurrent tibial arteries to knee-joint

Cutaneous – Two or three; supply integument of outer & back part of leg. one, the communicans fibularis, crosses outer head of gastrocnemius, and joins the communicans tibialis to form external or short saphenous nerve (V. below).

Anterior Tibial Nerve – Beneath extensor longus digitorum to front of interosseous membrane; along outer side, in front of, and again along outer side of anterior tibial artery to front of ankle-joint. – Supplies muscles of front of leg, and divides into:

EXTERNAL BRANCH – Beneath extensor brevis digitorum, which it supplies; becomes ganglionic, and supplies articulations of tarsus.

INTERNAL BRANCH – With dorsalis pedis artery along inner side of dorsum of foot; supplies adjoining sides of great & second toes, and joins with musculo-cutaneous.

Musculo-Cutaneous Nerve – Between peronei muscles, which it supplies, and extensor longus digitorum; pierces deep fascia about lower third of front of leg, and divides into:

INTERNAL BRANCH – Supplies inner side of great toe, adjoining sides of 2nd & 3rd toes, & integument of inner side of foot; joins with internal saphenous & anterior tibial.

EXTERNAL BRANCH – Supplies adjoining sides of 3rd, 4th, & 5th toes, and integument of outer side of foot; joins with external or short saphenous.

External Saphenous Nerve—Behind outer malleolus with external saphenous vein, and supplies integument of outer side of foot & little toe; joins with musculo-cutaneous. Is sometimes larger than usual, and then supplies both sides of little toe, and outer side of 4th.

EXTERNAL or SHORT SAPHENOUS VEIN — Commences at outer side of arch on dorsum of foot. Accompanies external or short saphenous nerve behind outer malleolus, along outer border of, & over, tendo Achillis, and between the two heads of gastrocnemius; it then perforates deep fascia at lower part of popliteal space, and opens into the popliteal. It receives numerous branches from back of leg, and communicates with deep veins on dorsum of foot & behind external malleolus. It is provided with two valves, one of which is always found near its termination.

LOWER LIMB

III.

GLUTEAL REGION, BACK OF THIGH, POPLITEAL SPACE.

MUSCLES of LOWER—4th Tablet.

GLUTEAL REGION.

Greatest part of one of largest muscles of body. Has two bony attachments, — Gluteus Maximus passes out, inserts in Fascia Lata. Gluteus Maximus — a Layer of the Glutei. Supplied by inferior gluteal nerve.

Gluteus Maximus – Superior curved line on dorsum ilii & rough surface between it & posterior fifth of crest of ilium; sides of lower part of sacrum and coccyx & tendinous expansion over back of sacrum; posterior surface of great sacro-sciatic ligament.

Fascia lata covering outer side of thigh, & rough line from great trochanter to linea aspera. – S. by inferior gluteal nerve.

Gluteus Medius – Dorsum ilii between superior & middle curved lines & outer lip of crest between them; fascia covering anterior part of the muscle.

Oblique line on outer surface of great trochanter. – S. by superior gluteal nerve.

Gluteus Minimus – Dorsum ilii between middle & inferior curved lines.

Anterior border of great trochanter. – S. by superior gluteal nerve.

Pyriformis – By three fleshy digitations from front of sacrum between first, second, third & fourth anterior sacral foramina & from grooves leading from them; margin of great sacro-sciatic foramen & anterior surface of great sacro-sciatic ligament

Posterior part of upper border of great trochanter. – S. by one of the muscular branches of sacral plexus.

Obturator Internus – Whole of inner surface of true pelvis in front of and behind obturator foramen; inner surface of obturator membrane & fibrous arch which completes canal for obturator vessels & nerve.

Upper border of great trochanter in front of pyriformis. – S. by one of the muscular branches of sacral plexus.

Gemellus Superior – Outer surface of spine of ischium.

Upper part of tendon of obturator internus. – S. by one of the muscular branches of sacral plexus.

Gemellus Inferior – Upper part of outer lip of tuberosity of ischium.

Lower border of tendon of obturator internus. – S. by one of the muscular branches of sacral plexus.

Quadratus Femoris – Outer border of tuberosity of ischium.

Upper part of linea quadrati on back of great trochanter. – S. by one of the muscular branches of sacral plexus.

Obturator Externus – Inner two-thirds of outer surface of obturator membrane; circumference of obturator foramen, and fibrous arch which completes canal for obturator vessels & nerve.

Digital fossa of femur. – S. by obturator nerve.

Fig. 234.—The gluteal, sciatic, & pudic nerves. (Hirschfeld.)

1, superior gluteal nerve; 6, 6, small sciatic nerve; 10, pudic nerve; 13, great sciatic nerve. (See expl., p. 150a.)

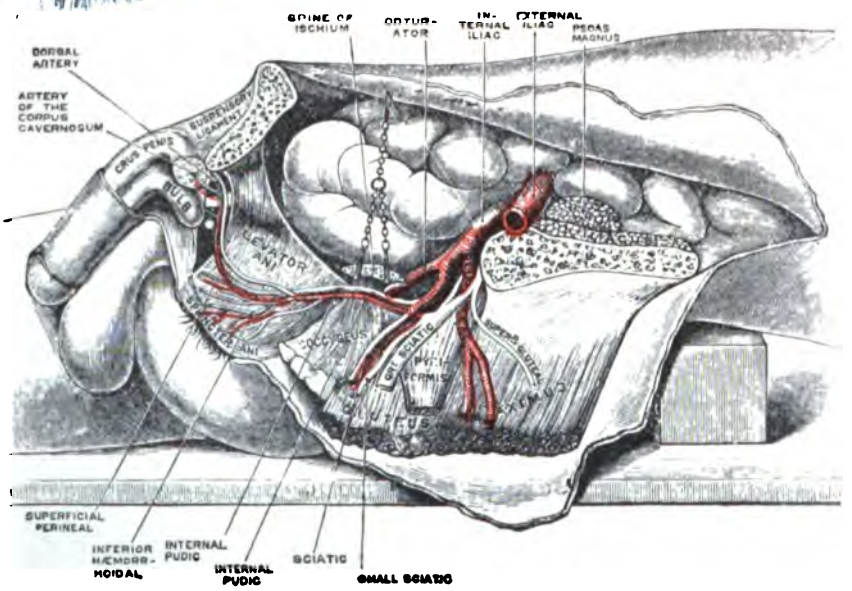


Fig. 235.—Entire course of pudic artery, seen from outer side. (Gray.) (See Fig. 238, p. 76b.)

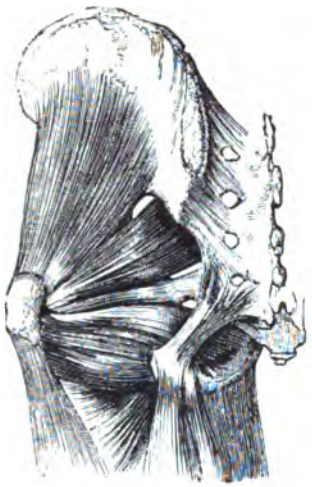


FIG. 235A.—THE DEEP MUSCLES OF THE GLUTEAL REGION. (Wilson.)

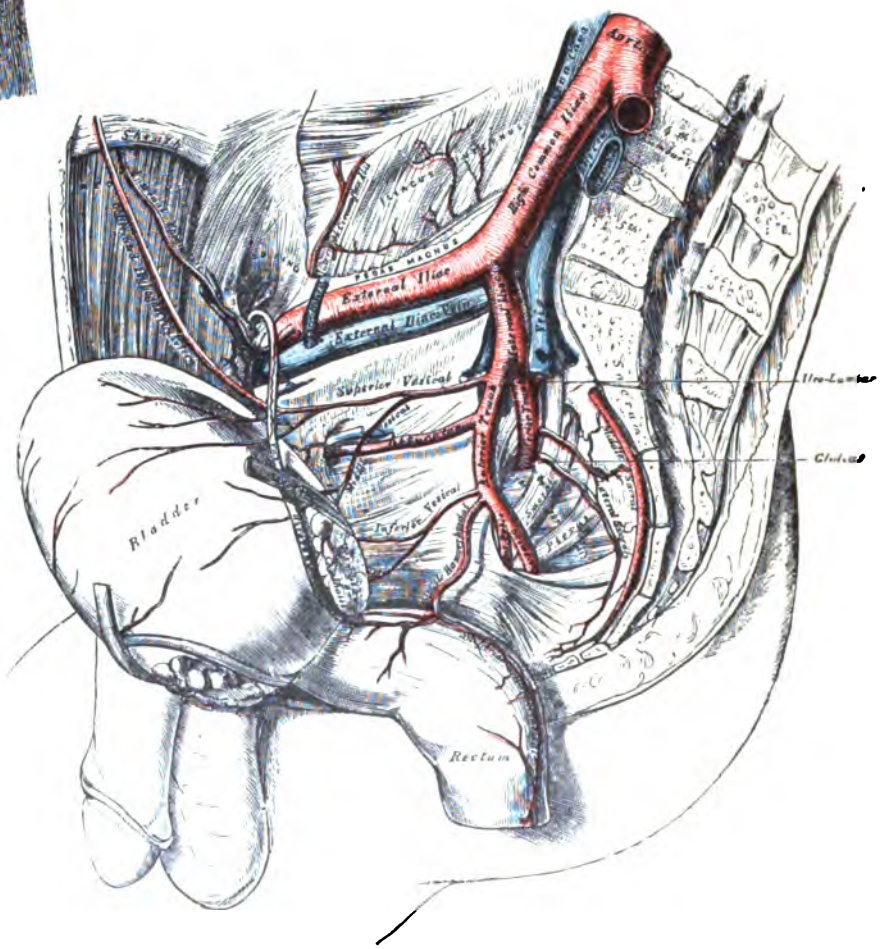


FIG. 236.—THE ARTERIES OF THE PELVIS (Gray.)

GLUTEAL ARTERY.

The largest branch of internal iliac, and the continuation of its posterior division.
Through great sacro-sciatic foramen above pyriformis, and then between latter muscle and gluteus medius, and divides into:
SUPERFICIAL BRANCH – Gives off numerous branches to gluteus maximus & integument over sacrum:
DEEP BRANCH – Forwards between glutei medius & minimus, and divides into:
Superior Division – Along upper border of gluteus minimus towards anterior superior spine of ilium, and joins with circumflex iliac.
Inferior Division – Crosses gluteus minimus towards great trochanter, and joins with ascending branch of external circumflex.

SUPERIOR GLUTEAL NERVE.

From back of lumbo-sacral cord.
With gluteal vessels through upper part of great sacro-sciatic foramen above pyriformis, and divides into:
SUPERIOR BRANCH – Along middle curved line on dorsum ilii with superior division of deep branch of gluteal artery. Supplies glutei medius & minimus
INFERIOR BRANCH – Directly forwards between glutei medius & minimus, which it also supplies, and terminates in tensor vaginæ femoris.

SCIATIC ARTERY.

The larger of the two terminal branches of anterior division of internal iliac artery, and the largest branch of the artery after gluteal.
Downwards in front of pyriformis & sacral plexus, lying a little behind & to outer side of internal pudic.
Through great sacro-sciatic foramen below pyriformis and between great sciatic nerve & pudic vessels & nerve.
With small sciatic nerve over gemelli, obturator internus & quadratus femoris and in front of gluteus maximus.
Gives off branches:
MUSCULAR, ARTICULAR to hip-joint;
COCCYGEAL, INFERIOR GLUTEAL;
COMES NERVI ISCHIADICI – Long, slender; with, and subsequently within sheath of, great sciatic nerve to lower part of thigh.

SMALL SCIATIC NERVE.

From lower & back part of sacral plexus.
With sciatic vessels through lower part of great sacro-sciatic foramen below pyriformis.
Descends beneath gluteus maximus on inner side of great sciatic nerve.
Along back of thigh beneath fascia lata to lower part of popliteal space.
Perforates deep fascia, and accompanies external saphenous vein to skin of back of leg; communicates with external saphenous nerve.
Gives off branches:
INFERIOR GLUTEAL – Several, large; to under surface of gluteus maximus.
INFERIOR PUDENDAL – Forwards below tuber ischii to skin of perinæum and upper & inner part of thigh, and to scrotum or labium.
CUTANEOUS – *Descending.* To skin of inner & outer sides of back of thigh, popliteal space and back of leg.
Ascending. Wind round lower border of gluteus maximus to integument over its surface.

MUSCULAR BRS. OF SACRAL PLEXUS.

To pyriformis, obturator internus, gemelli & quadratus femoris.
The nerve to obturator internus passes behind spine of ischium and through lesser sacro-sciatic foramen to inner surface of the muscle.
The gemellus inferior and the quadratus femoris are supplied by a common branch, which runs between capsule of hip-joint and the obturator internus & gemelli, and gives off an articular filament to the joint

PUDIC ARTERY.

The smaller of the two terminal branches of anterior division of internal iliac artery.

Descends in front of pyriformis & sacral plexus, lying to the inner side & a little in front of sciatic artery.

With pudic nerve through lower part of great sacro-sciatic foramen below pyriformis on inner side of sciatic nerves & sciatic artery.

Winds round spine of ischium and re-enters pelvis through lesser sacro-sciatic foramen.

Forwards along outer wall of ischio-rectal fossa below pudic nerve, being covered by obturator fascia, and lying at first 1½ inches above lower extremity of tuber ischii, but approaching surface as it progresses.

Pierces deep layer of deep perinæal fascia, and ascends along pubic arch between the two layers of that fascia to near symphysis pubis.

Pierces superficial layer of deep perinæal fascia, and divides into artery of corpus cavernosum and dorsal artery of penis.

It gives off: – *Inferior Hæmorrhoidal, Superficial Perinæal, Transverse Perinæal, Artery of the Bulb, & Artery of the Corpus Cavernosum.*

PUDIC NERVE.

From lower part of sacral plexus.

With pudic artery through lower part of great sacro-sciatic foramen on inner side of great sciatic nerve.

Winds round spine of ischium, and re-enters pelvis through lesser sacro-sciatic foramen, where it gives off inferior hæmorrhoidal nerve.

Forwards along outer wall of ischio-rectal fossa above pudic artery, both nerve & artery being covered by obturator fascia, and divides into perinæal nerve & dorsal nerve of the penis.

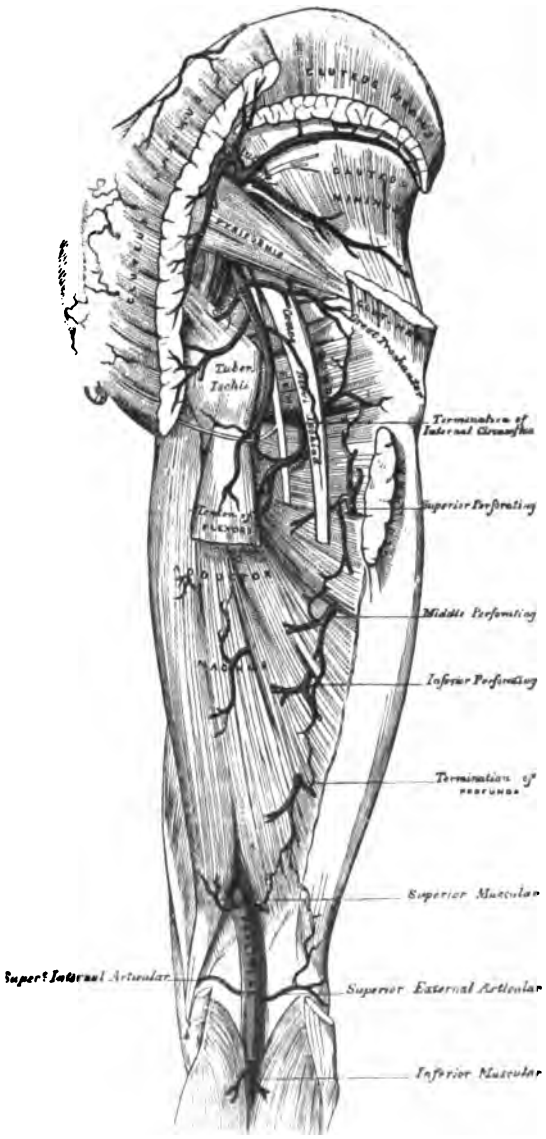


FIG. 237.—THE ARTERIES OF THE GLUTEAL AND POSTERIOR FEMORAL REGIONS. (Gray.)

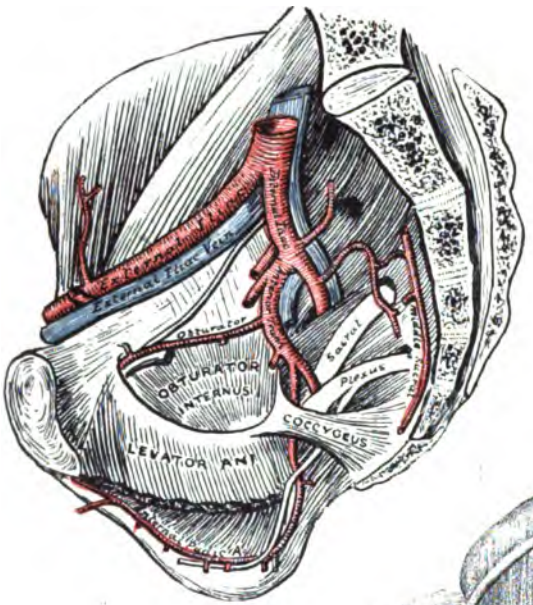


FIG. 238.—ENTIRE COURSE OF PUDIC ARTERY AS SEEN FROM THE INNER SIDE. (After Bourgery & Jacob and Testut.) (See Fig. 357, p. 151a.)

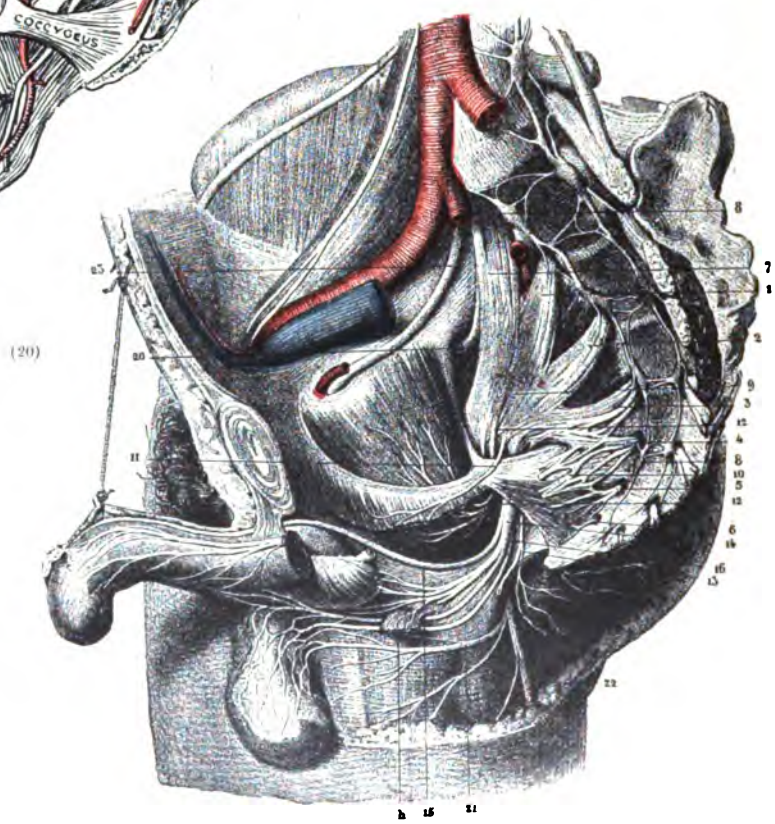


FIG. 239.—SACRAL PLEXUS. (Hirschfeld.)

7, lumbo-sacral cord; 1, 2, 3, 4, 5, the five sacral nerves; 6, the coccygeal nerve; 9, sacral plexus; 14, pudic nerve; 20, superior gluteal nerve; 22, small sciatic nerve; 23, obturator nerve. (See expl., p. 96h.)

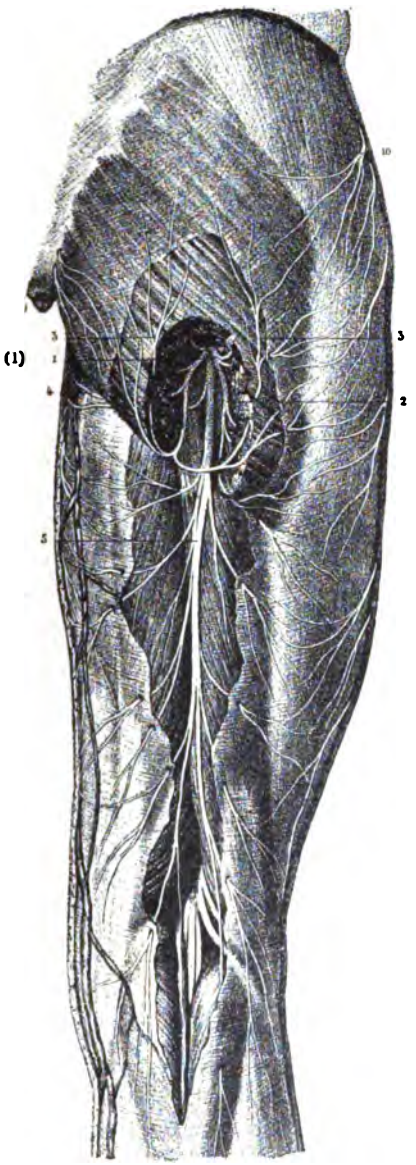


FIG. 240.—POSTERIOR NERVES OF THE THIGH & HIP: SUPERFICIAL DISSECTION. (Hirschfeld.)

1, small sciatic nerve; 2, its inferior gluteal branch 4, its inferior pudendal branch. (See expl., p. 96h.)

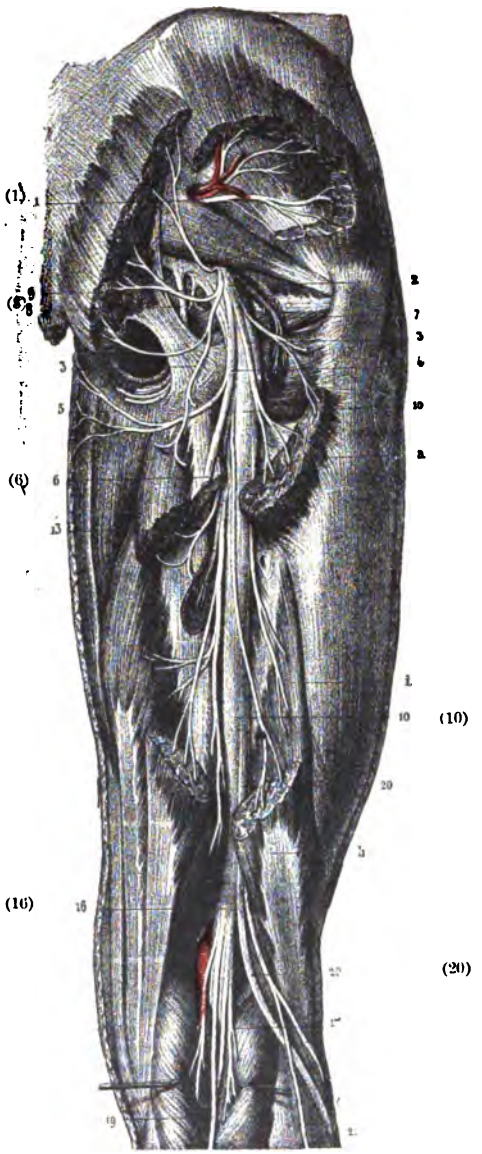


FIG. 241.—POSTERIOR NERVES OF THE THIGH & HIP: DEEP DISSECTION. (Hirschfeld.)

1, superior gluteal nerve; 2, small sciatic nerve; 5, its inferior pudendal branch; 8, pudic nerve, and, 9, nerve to the obturator internus; 10, 10, great sciatic nerve; 19, communicans tibialis; 20, external popliteal nerve, giving off communicans fibularis. (See expl., p. 96h.)

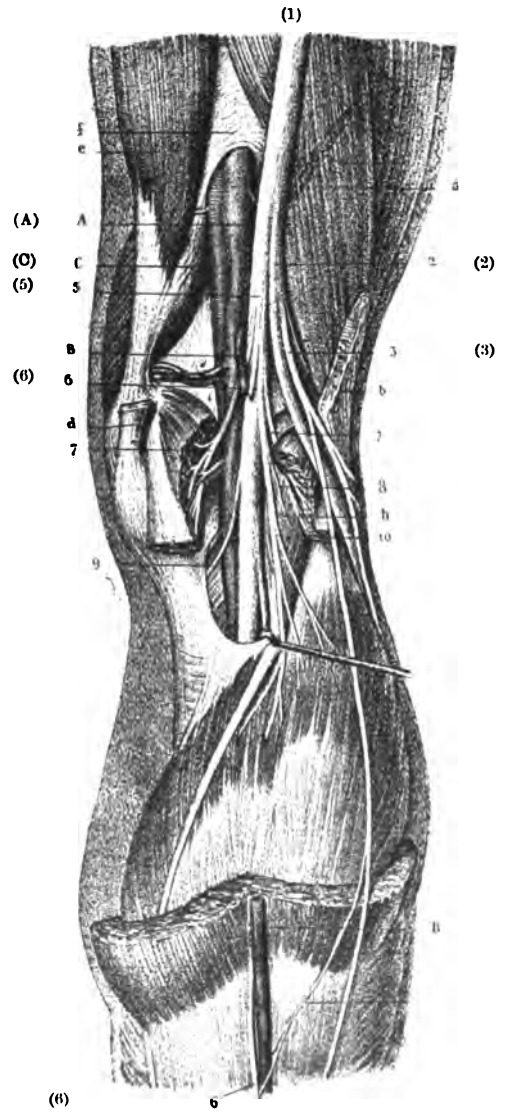


FIG. 242. - POPLITEAL VESSELS AND NERVES. (Hirschfeld.)

1, great sciatic nerve; 2, external popliteal nerve; 3, communicans fibularis; 5, internal popliteal nerve; 6, 6, communicans tibialis; A, popliteal vein, receiving the short saphenous; C, popliteal artery; B, B, external or short saphenous vein. (See expl., p. 96h.)

MUSCLES of LOWER LIMB—5th Tablet.

POSTERIOR FEMORAL REGION (Hamstring Muscles).

Biceps.

LONG HEAD – In common with semitendinosus from lower & inner of the two surfaces on back part of tuberosity of ischium.

SHORT HEAD – Whole length of outer lip of linea aspera between adductor magnus & vastus externus and from inferior external division of linea aspera to within two inches of outer condyle.

Outer side of head of fibula by a strong tendon, which divides into two parts to embrace long external lateral ligament of knee-joint, sends a fibrous prolongation to outer tuberosity of tibia, and gives off an expansion to fascia of leg. – S. by great sciatic nerve.

Semitendinosus – In common with long head of biceps from lower & inner of the two surfaces on back part of tuberosity of ischium.

Upper part of inner surface of shaft of tibia below gracilis & beneath sartorius – S. by great sciatic nerve.

Semimembranosus – Upper and outer of the two surfaces on back part of tuberosity of ischium above & on outer side of origin of biceps & semitendinosus.

By a tendon which divides into three portions, into:

Posterior part of inner tuberosity of tibia, sending an expansion over popliteus;

Groove on inner side of inner tuberosity of tibia beneath internal lateral ligament of knee-joint;

Posterior & upper part of outer condyle of femur, forming chief part of posterior ligament of knee-joint. – S. by great sciatic nerve

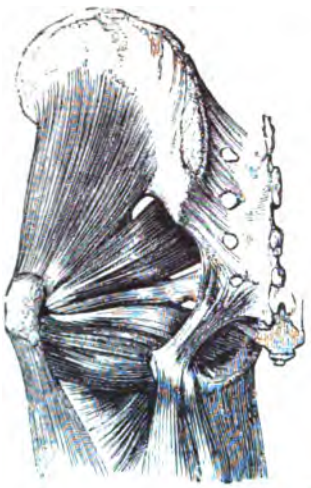


FIG. 235A.—THE DEEP MUSCLES OF THE GLUTEAL REGION. (Wilson.)

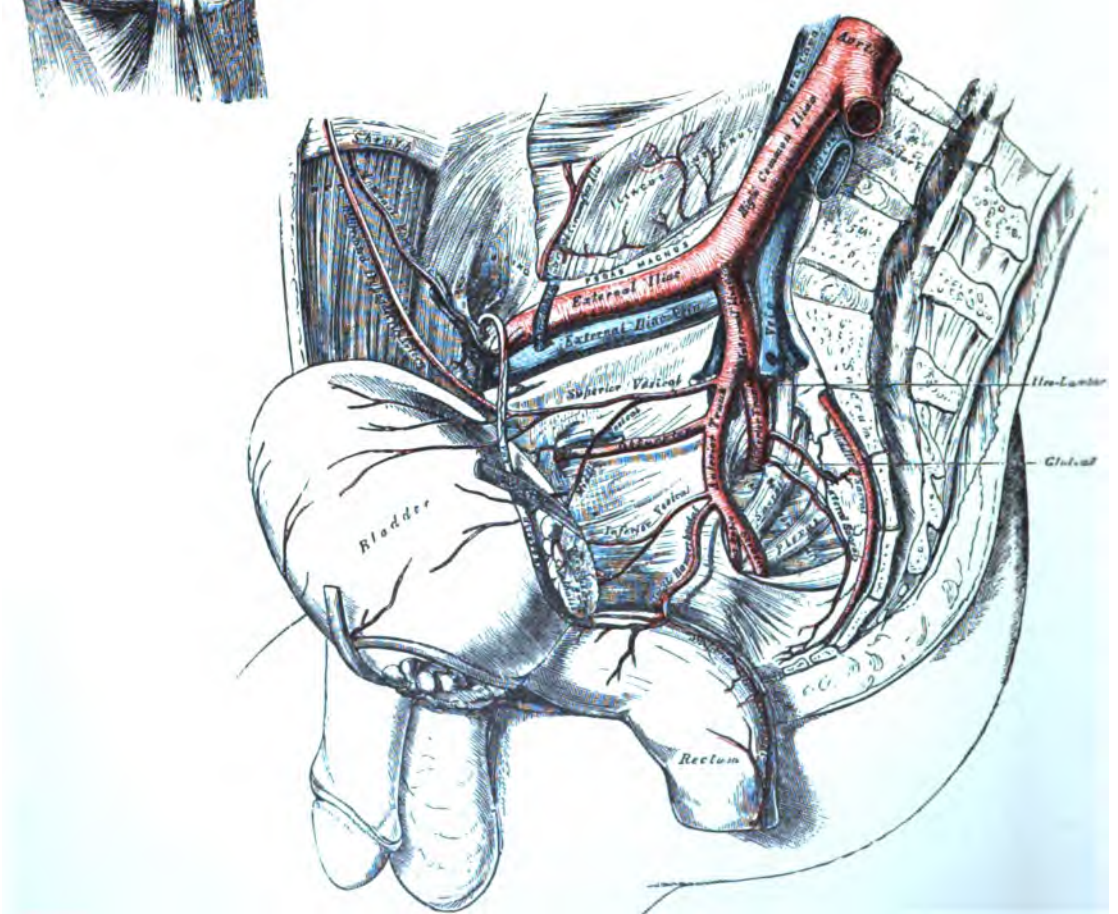


FIG. 236.—THE ARTERIES OF THE PELVIS (Gray.)

GLUTEAL ARTERY.

The largest branch of internal iliac, and the continuation of its posterior division.
Through great sacro-sciatic foramen above pyriformis, and then between latter muscle and gluteus medius, and divides into:
SUPERFICIAL BRANCH – Gives off numerous branches to gluteus maximus & integument over sacrum:
DEEP BRANCH – Forwards between glutei medius & minimus, and divides into:
Superior Division – Along upper border of gluteus minimus towards anterior superior spine of ilium, and joins with circumflex iliac.
Inferior Division – Crosses gluteus minimus towards great trochanter, and joins with ascending branch of external circumflex.

SUPERIOR GLUTEAL NERVE.

From back of lumbo-sacral cord.
With gluteal vessels through upper part of great sacro-sciatic foramen above pyriformis, and divides into:
SUPERIOR BRANCH – Along middle curved line on dorsum ilii with superior division of deep branch of gluteal artery. Supplies glutei medius & minimus
INFERIOR BRANCH – Directly forwards between glutei medius & minimus, which it also supplies, and terminates in tensor vaginæ femoris.

SCIATIC ARTERY.

The larger of the two terminal branches of anterior division of internal iliac artery, and the largest branch of the artery after gluteal.
Downwards in front of pyriformis & sacral plexus, lying a little behind & to outer side of internal pudic.
Through great sacro-sciatic foramen below pyriformis and between great sciatic nerve & pudic vessels & nerve.
With small sciatic nerve over gemelli, obturator internus & quadratus femoris and in front of gluteus maximus.
Gives off branches:
MUSCULAR, ARTICULAR to hip-joint;
COCCYGEAL, INFERIOR GLUTEAL;
COMES NERVI ISCHIADICI – Long, slender; with, and subsequently within sheath of, great sciatic nerve to lower part of thigh.

SMALL SCIATIC NERVE.

From lower & back part of sacral plexus.
With sciatic vessels through lower part of great sacro-sciatic foramen below pyriformis.
Descends beneath glutæus maximus on inner side of great sciatic nerve.
Along back of thigh beneath fascia lata to lower part of popliteal space.
Perforates deep fascia, and accompanies external saphenous vein to skin of back of leg; communicates with external saphenous nerve.
Gives off branches:
INFERIOR GLUTEAL – Several, large; to under surface of gluteus maximus.
INFERIOR PUDENDAL – Forwards below tuber ischii to skin of perinæum and upper & inner part of thigh, and to scrotum or labium.
CUTANEOUS – *Descending.* To skin of inner & outer sides of back of thigh, popliteal space and back of leg.
Ascending. Wind round lower border of gluteus maximus to integument over its surface.

MUSCULAR BRS. OF SACRAL PLEXUS.

To pyriformis, obturator internus, gemelli & quadratus femoris.
The nerve to obturator internus passes behind spine of ischium and through lesser sacro-sciatic foramen to inner surface of the muscle.
The gemellus inferior and the quadratus femoris are supplied by a common branch, which runs between capsule of hip-joint and the obturator internus & gemelli, and gives off an articular filament to the joint

PUDIC ARTERY.

The smaller of the two terminal branches of anterior division of internal iliac artery.

Descends in front of pyriformis & sacral plexus, lying to the inner side & a little in front of sciatic artery.

With pudic nerve through lower part of great sacro-sciatic foramen below pyriformis on inner side of sciatic nerves & sciatic artery.

Winds round spine of ischium and re-enters pelvis through lesser sacro-sciatic foramen.

Forwards along outer wall of ischio-rectal fossa below pudic nerve, being covered by obturator fascia, and lying at first 1½ inches above lower extremity of tuber ischii, but approaches surface as it progresses.

Pierces deep layer of deep perinæal fascia, and ascends along pubic arch between the two layers of that fascia to near symphysis pubis.

Pierces superficial layer of deep perinæal fascia, and divides into artery of corpus cavernosum and dorsal artery of penis.

It gives off: – *Inferior Hæmorrhoidal, Superficial Perinæal, Transverse Perinæal, Artery of the Bulb, & Artery of the Corpus Cavernosum.*

PUDIC NERVE.

From lower part of sacral plexus.

With pudic artery through lower part of great sacro-sciatic foramen on inner side of great sciatic nerve.

Winds round spine of ischium, and re-enters pelvis through lesser sacro-sciatic foramen, where it gives off inferior hæmorrhoidal nerve.

Forwards along outer wall of ischio-rectal fossa above pudic artery, both nerve & artery being covered by obturator fascia, and divides into perinæal nerve & dorsal nerve of the penis.

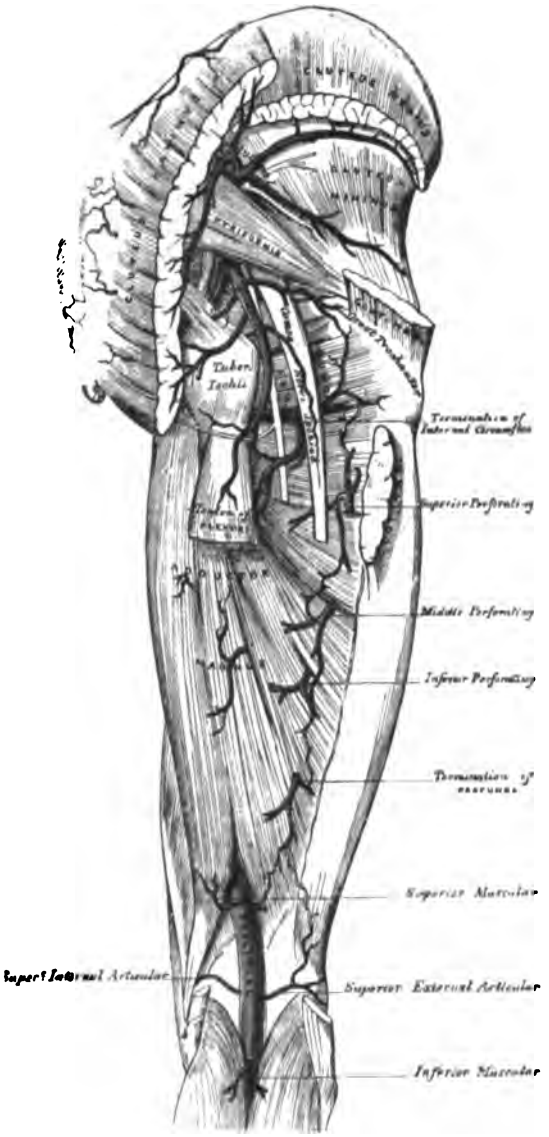


FIG. 237.—THE ARTERIES OF THE GLUTEAL AND POSTERIOR FEMORAL REGIONS. (Gray.)

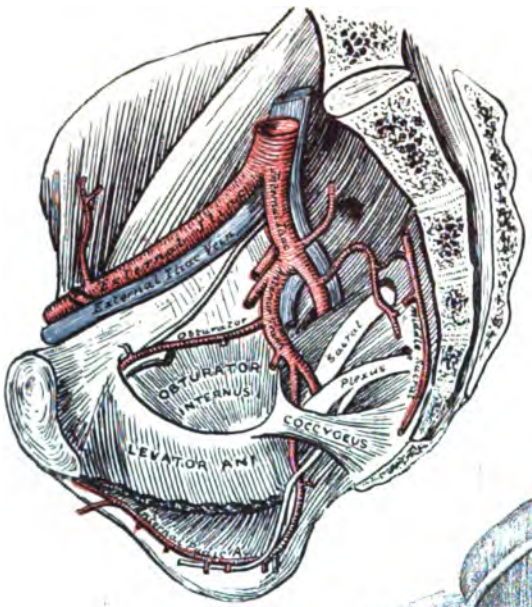


FIG. 238.—ENTIRE COURSE OF PUDIC ARTERY AS SEEN FROM THE INNER SIDE. (After Bourgery & Jacob and Testut.) (See Fig. 357, p. 151a.)

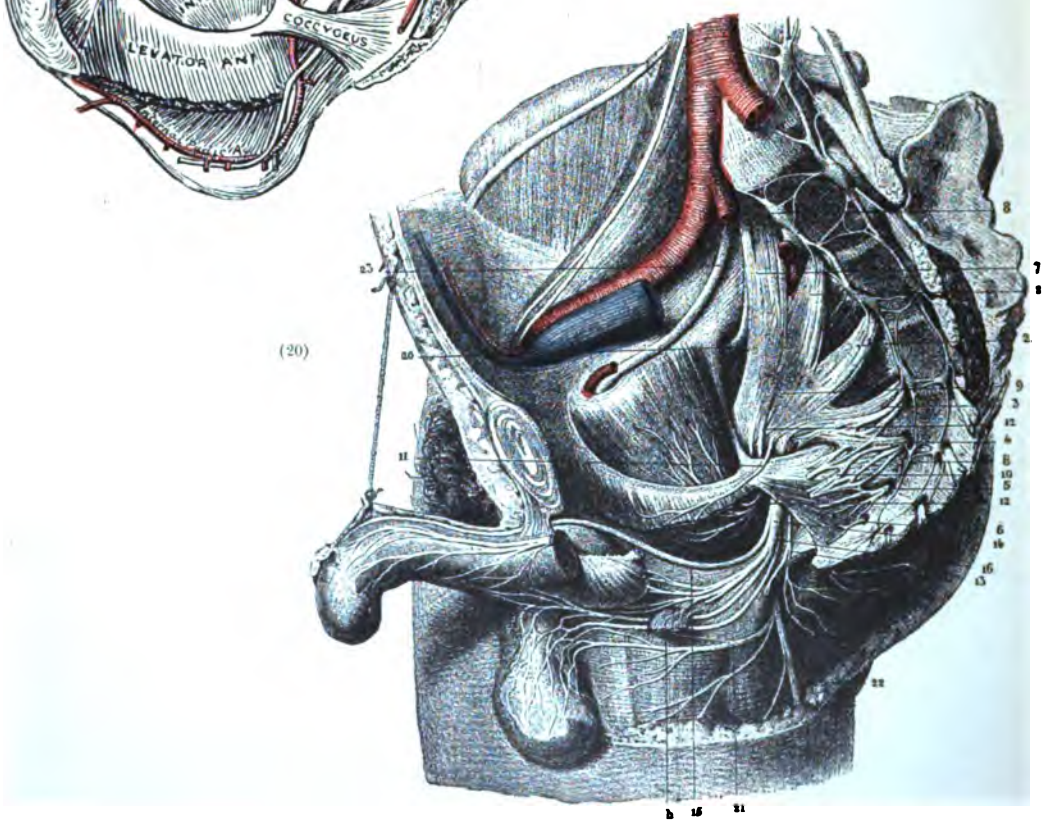


FIG. 239.—SACRAL PLEXUS. (Hirschfeld.)

7, lumbo-sacral cord; 1, 2, 3, 4, 5, the five sacral nerves; 6, the coccygeal nerve; 9, sacral plexus; 14, pudic nerve; 20, superior gluteal nerve; 22, small sciatic nerve; 23, obturator nerve. (See expl., p. 96h.)

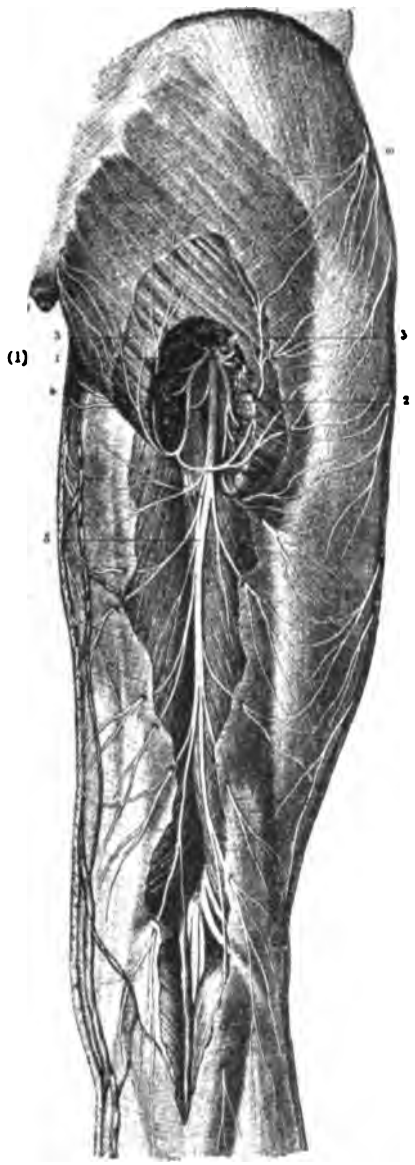


FIG. 240.—POSTERIOR NERVES OF THE THIGH & HIP: SUPERFICIAL DISSECTION. (Hirschfeld.)

1, small sciatic nerve; 2, its inferior gluteal branch 4, its inferior pudendal branch. (See expl., p. 96h.)

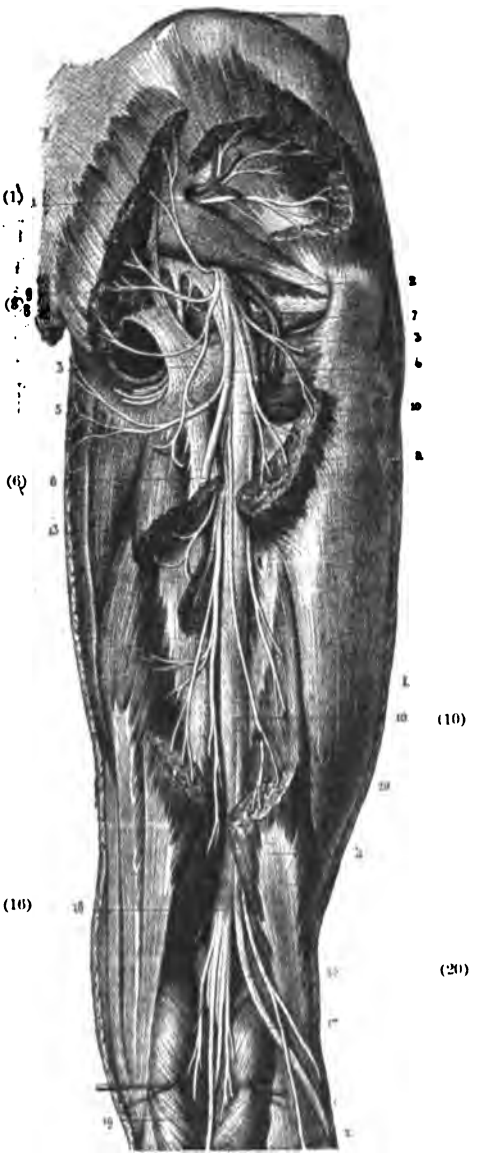


FIG. 241.—POSTERIOR NERVES OF THE THIGH & HIP: DEEP DISSECTION. (Hirschfeld.)

1, superior gluteal nerve; 2, small sciatic nerve; 5, its inferior pudendal branch; 8, pudic nerve, and, 9, nerve to the obturator internus; 10, 10, great sciatic nerve; 19, communicans tibialis; 20, external popliteal nerve, giving off communicans fibularis. (See expl., p. 96h.)

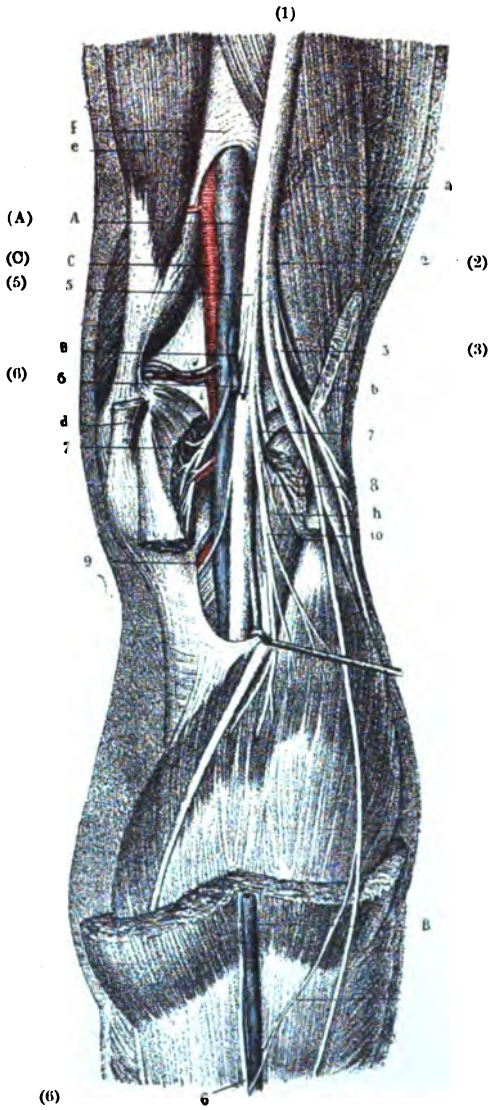


FIG. 242.—POPLITEAL VESSELS AND NERVES. (Hirschfeld.)

1, great sciatic nerve; 2, external popliteal nerve; 3, communicans fibularis; 5, internal popliteal nerve; 6, 6, communicans tibialis; A, popliteal vein, receiving the short saphenous; C, popliteal artery; B, B, external or short saphenous vein. (See expl., p. 96h.)

MUSCLES of LOWER LIMB—5th Tablet.

POSTERIOR FEMORAL REGION (Hamstring Muscles).

Biceps.

LONG HEAD – In common with semitendinosus from lower & inner of the two surfaces on back part of tuberosity of ischium.

SHORT HEAD – Whole length of outer lip of linea aspera between adductor magnus & vastus externus and from inferior external division of linea aspera to within two inches of outer condyle.

Outer side of head of fibula by a strong tendon, which divides into two parts to embrace long external lateral ligament of knee-joint, sends a fibrous prolongation to outer tuberosity of tibia, and gives off an expansion to fascia of leg. – S. by great sciatic nerve.

Semitendinosus – In common with long head of biceps from lower & inner of the two surfaces on back part of tuberosity of ischium.

Upper part of inner surface of shaft of tibia below gracilis & beneath sartorius – S. by great sciatic nerve.

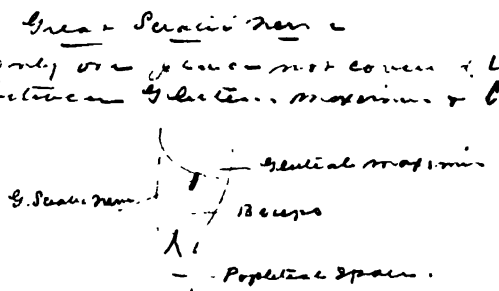
Semimembranosus – Upper and outer of the two surfaces on back part of tuberosity of ischium above & on outer side of origin of biceps & semitendinosus.

By a tendon which divides into three portions, into:

Posterior part of inner tuberosity of tibia, sending an expansion over popliteus;

Groove on inner side of inner tuberosity of tibia beneath internal lateral ligament of knee-joint;

Posterior & upper part of outer condyle of femur, forming chief part of posterior ligament of knee-joint. – S. by great sciatic nerve



GREAT SCIATIC NERVE.

Arises from the lumbo-sacral cord & the four upper sacral nerves, and is the continuation of the sacral plexus.

Through great sacro-sciatic foramen below pyriformis, on outer side of pudic vessels & nerve.

Downwards between trochanter major & tuber ischii, behind external rotator muscles & adductor magnus, to lower third of back of thigh, where it divides into external & internal popliteal.

Is covered by gluteus maximus & biceps. Gives off branches:

Articular – To back of hip-joint.

Muscular – To hamstring muscles & adductor magnus.

EXTERNAL POPLITEAL NERVE.

The smaller of the two terminal branches of great sciatic.

Along outer side of popliteal space close to biceps.

Pierces peroneus longus an inch below head of fibula, and divides into anterior tibial & musculo-cutaneous. Gives off branches: –

Articular – Three; accompany the two external articular & the recurrent tibial arteries to knee-joint.

Cutaneous – Two or three; supply integument of outer & back part of leg; one, the communicans fibularis, crosses outer head of gastrocnemius, and joins the communicans tibialis to form external or short saphenous nerve (V. next Tablet).

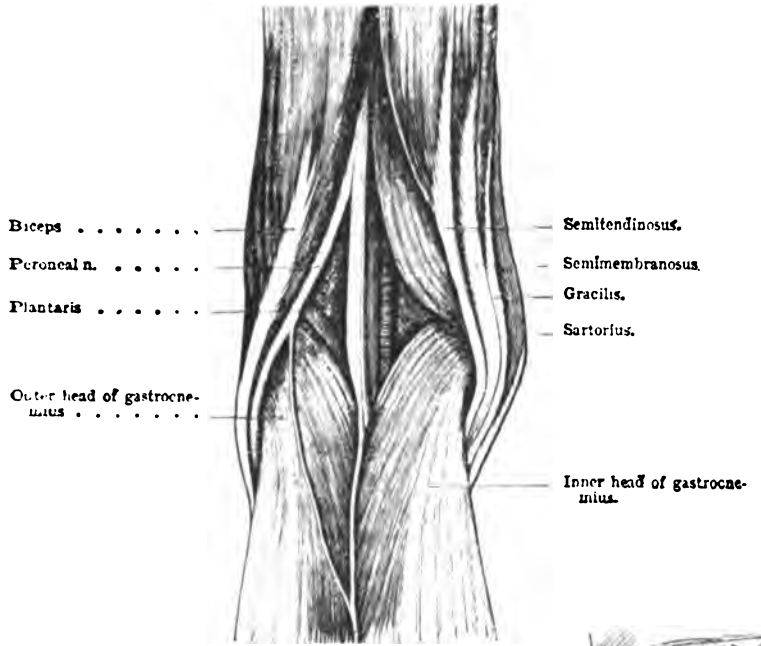


FIG. 213.—THE LEFT POPLITEAL SPACE. (Holden.)

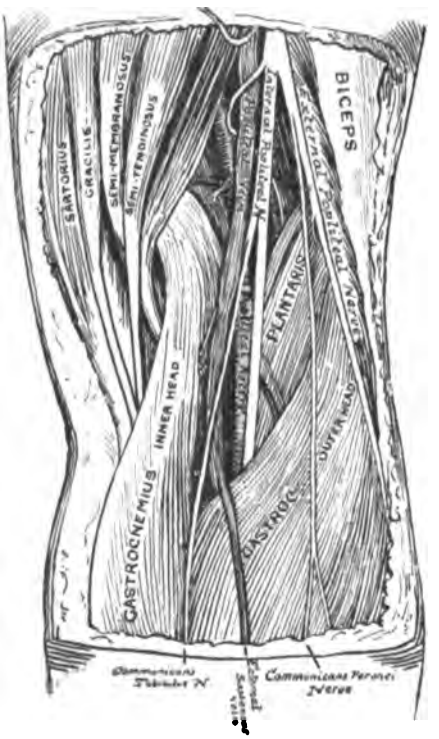


FIG. 214.—THE RIGHT POPLITEAL SPACE. (After Heath.)

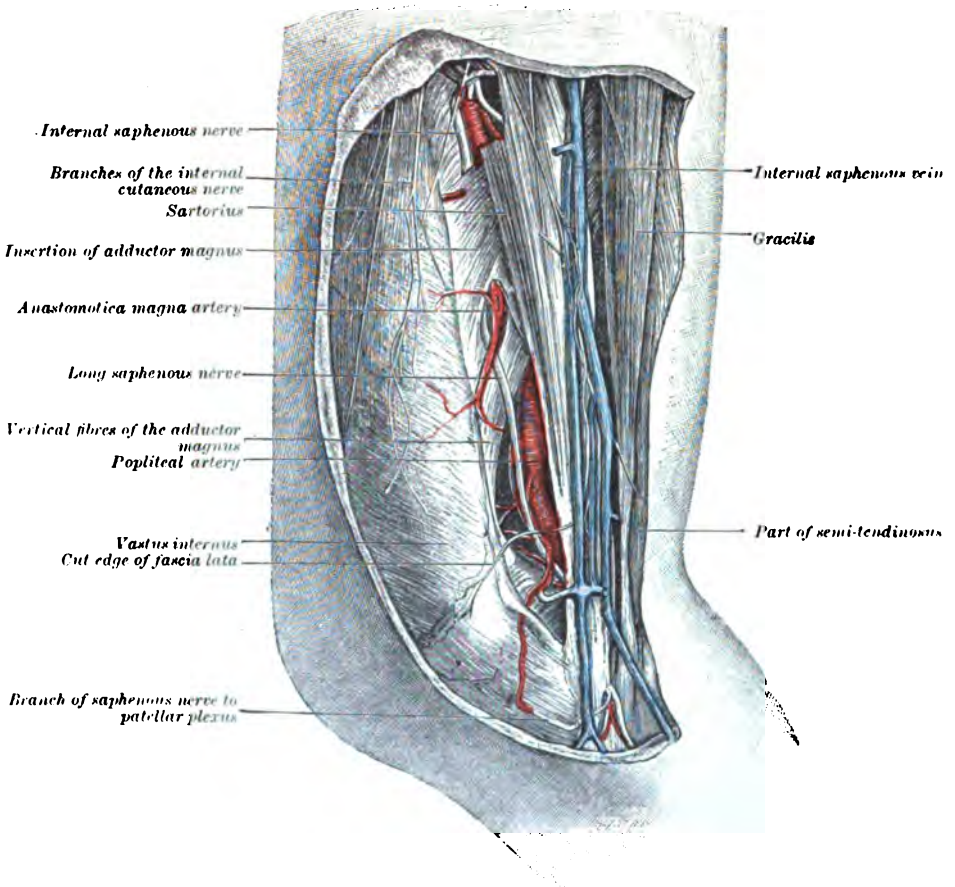


FIG. 245.—THE POPLITEAL ARTERY, SEEN FROM THE INNER SIDE. (Morris.)

INTERNAL POPLITEAL NERVE.

The larger of the two terminal branches of great sciatic.

Through middle of popliteal space to lower border of popliteus, where it becomes posterior tibial.

Is first superficial & external and at a distance from, then superficial & internal and close to, popliteal vessels. – Its branches are·

Articular – Three; accompany the two internal & the azygos articular arteries to knee-joint.

Muscular – To gastrocnemius, plantaris, popliteus, soleus.

Communicans Tibialis – Between heads of gastrocnemius to middle of back of leg, where it pierces deep fascia and joins communicans fibularis to form the

External Saphenous Nerve – Behind outer malleolus with external saphenous vein, and supplies integument of outer side of foot & little toe; joins with musculo-cutaneous. Is sometimes larger than usual, and then supplies both sides of little toe, and outer side of 4th.

POPLITEAL ARTERY.

Commences at opening in lower part of adductor magnus.
Downwards & outwards to back of knee-joint, and then vertically downwards to lower border of popliteus muscle, where divides into anterior & posterior tibial

RELATIONS:

In Front – Inner & posterior surfaces of femur, posterior ligament of knee-joint, popliteus muscle.

Behind – Skin & fascia; quantity of fat & lymphatic glands; semimembranosus; gastrocnemius, plantaris, soleus; popliteal vein, internal popliteal nerve

On Inner Side – Semimembranosus; inner condyle; inner head of gastrocnemius.

On Outer Side – Biceps; outer condyle; outer head of gastrocnemius, plantaris

Popliteal vein lies close to artery, and is superficial & external to it except at lower part, where it crosses to inner side; it is frequently double at lower part. – Internal popliteal nerve is more superficial & external above, and is superficial & internal below

BRANCHES:

MUSCULAR:

Superior — Two or three, small, to hamstring muscles & vasti. Anastomose with perforating & articular arteries

Inferior or Sural — Two, large, to heads of gastrocnemius & plantaris

CUTANEOUS: — A few, slender; arise separately or with sural. Over gastrocnemius to integument of back of leg

ARTICULAR — Five:

Superior - Two. Wind round femur above condyles to front of knee, passing, the

Internal, - Beneath tendon of adductor magnus;

External, - Beneath tendon of biceps; and both dividing into

Superficial & deep brs. - to vasti, femur & joint, and anastomosing with each other, and with inferior articular arteries, anastomotica magna & descending branch of external circumflex.

Azygos - Arises behind posterior ligament of knee-joint, which it pierces to supply interarticular ligaments & synovial membrane

Inferior - Two. Arise beneath gastrocnemius, and wind round head of tibia beneath internal & external lateral ligaments, the external artery passing above head of fibula & beneath tendon of biceps. Divide into numerous branches to front of knee, and anastomose with each other, and with superior articular & the recurrent branch of tibial

LOWER LIMB.

IV.

BACK OF LEG; SOLE OF FOOT.

POPLITEAL ARTERY

Commences at opening in lower part of adductor magnus.
Downwards & outwards to back of knee-joint, and then vertically downwards to lower border of popliteus muscle, where divides into anterior & posterior tibial.

RELATIONS:

In Front – Inner & posterior surfaces of femur, posterior ligament of knee-joint, popliteus muscle.
Behind – Skin & fascia; quantity of fat & lymphatic glands; semimembranosus; gastrocnemius, plantaris, soleus; popliteal vein, internal popliteal nerve.
On Inner Side – Semimembranosus; inner condyle; inner head of gastrocnemius.
On Outer Side – Biceps; outer condyle; outer head of gastrocnemius, plantaris.
Popliteal vein lies close to artery, and is superficial & external to it except at lower part, where it crosses to inner side; it is frequently double at lower part. – Internal popliteal nerve is more superficial & external above, and is superficial & internal below.

BRANCHES:

MUSCULAR:

Superior — Two or three, small, to hamstring muscles & vasti. Anastomose with perforating & articular arteries.
Inferior or Sural — Two, large, to heads of gastrocnemius & plantaris.

CUTANEOUS: — A few, slender; arise separately or with sural. Over gastrocnemius to integument of back of leg.

ARTICULAR — Five:

Superior – Two. Wind round femur above condyles to front of knee, passing, the
Internal, – Beneath tendon of adductor magnus;
External, – Beneath tendon of biceps; and both dividing into
Superficial & deep brs. – to vasti, femur & joint, and anastomosing with each other, and with inferior articular arteries, anastomotica magna & descending branch of external circumflex.
Azygos – Arises behind posterior ligament of knee-joint, which it pierces to supply interarticular ligaments & synovial membrane.
Inferior – Two. Arise beneath gastrocnemius, and wind round head of tibia beneath internal & external lateral ligaments, the external artery passing above head of fibula & beneath tendon of biceps. Divide into numerous branches to front of knee, and anastomose with each other, and with superior articular & the recurrent branch of tibial.

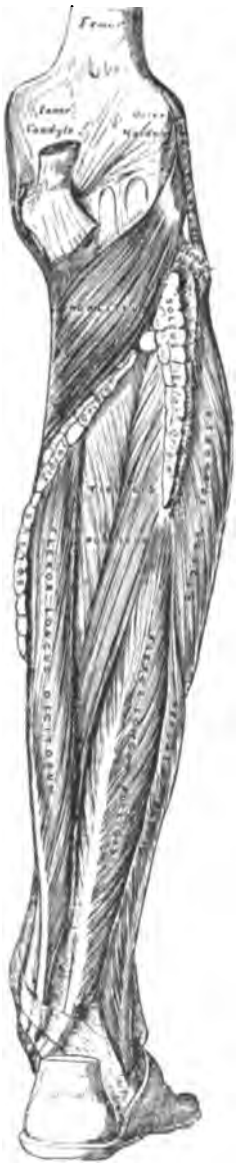


FIG. 246.- MUSCLE OF THE BACK OF THE LEG, DEEP LAYER. (Gray.)

FIG 247.— THE POPLITEAL, POSTERIOR TIBIAL AND PERONEAL ARTERIES. (Gray.)

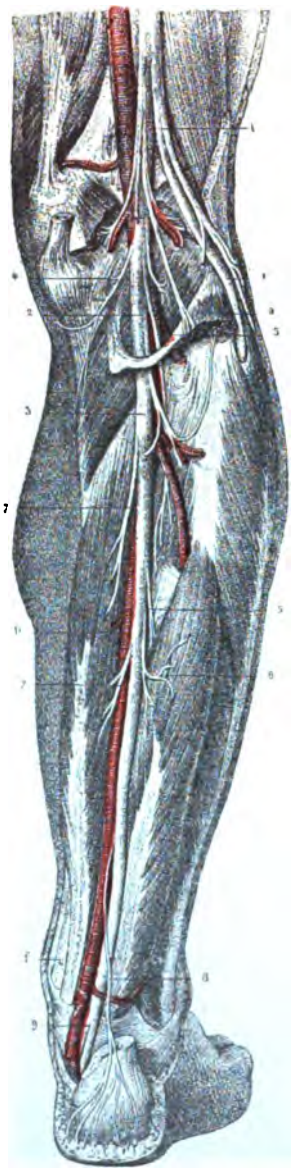


FIG. 248. —DEEP NERVES OF BACK OF LEG. (Hirschfeld.)

1, external popliteal nerve; 2, internal popliteal nerve; 3, posterior tibial nerve. (See expl., p. 96h.)

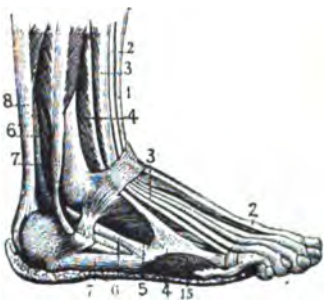


FIG. 249.—OUTER SIDE OF RIGHT ANKLE. (Sappey.)

1, tibialis anticus; 2, extensor proprius pollicis; 3, extensor longus digitorum; 4, peroneus tertius; 5, extensor brevis digitorum; 6, peroneus brevis; 7, peroneus longus; 8, tendo Achillis.

FIG. 250.—INNER SIDE OF RIGHT ANKLE. (Sappey.)

1, tibialis anticus; 8, tendo Achillis; 9, tibialis posticus; 10, flexor longus digitorum; 11, flexor longus pollicis; 12, plantaris.

MUSCLES of LOWER LIMB—6th Tablet.

POSTERIOR TIBIO-FIBULAR REGION.

SUPERFICIAL LAYER.

Gastrocnemius.

INNER HEAD – Depression at upper and back part of inner condyle.

OUTER HEAD – Depression at upper & back part of outer condyle above groove for popliteus. – Both heads also arise from lower part of the two inferior divisions of linea aspera.

By a strong aponeurosis which covers front of the muscle, and contracts into a tendon which joins with that of soleus, into lower part of posterior surface of os calcis. – S. by internal popliteal nerve.

Soleus – Back of head & upper third of posterior surface of shaft of fibula; middle third of inner border and oblique line on posterior surface of shaft of tibia; tendinous arch between tibial & fibular origins of the muscle beneath which arch pass posterior tibial vessels & nerve.

By a strong aponeurosis which covers posterior surface of the muscle and contracts into a tendon which joins with that of gastrocnemius (Tendo Achillis), into lower part of posterior surface of os calcis. – S. by internal popliteal nerve.

Plantaris – Lower part of outer division of linea aspera & post. ligament of knee-joint. Joins inner border of tendo Achillis. – S. by internal popliteal nerve.

DEEP LAYER.

Popliteus – Anterior & deepest part of groove on outer side of outer condyle of femur below tubercle for external lateral ligament of knee-joint.

Inner two-thirds of triangular surface on back of upper part of tibia above oblique line. – S. by internal popliteal nerve.

Flexor Longus Pollicis – Lower two-thirds of posterior surface of shaft of fibula; lower part of interosseous membrane; intermuscular septum between it & peronei; fascia over tibialis posticus.

Base of the last phalanx of great toe. – S. by posterior tibial nerve.

Flexor Longus Digitorum – Posterior surface of shaft of tibia below oblique line & internally to attachment of tibialis posticus; fascia over tibialis posticus.

Bases of last phalanges of four outer toes. – S. by posterior tibial nerve.

Tibialis Posticus – "Passing" muscle – muscle into all bones of sole of foot except 1st & 5th metatarsal (astragalus – not on sole of foot)

Tibialis Posticus – Posterior surface of shaft of tibia below oblique line & externally to attachment of flexor longus digitorum; nearly whole of posterior surface of interosseous membrane; upper three-fourths of inner surface of shaft of fibula; fascia between it & foregoing muscles.

Tuberosity of scaphoid and internal & external cuneiform bones. – Supplied by posterior tibial nerve.

Two muscles groove 3 bones –
1. Peroneus longus { fibula / cuneiform
2. Flexor longus hallucis { tibia / astragalus

POSTERIOR TIBIAL ARTERY

Posterior & larger branch of bifurcation of popliteal opposite lower border of popliteus muscle.

Downwards & inwards upon tibialis posticus, flexor longus digitorum, lower end of tibia & ankle joint, being covered by gastrocnemius, soleus and deep layer of fascia in upper two-thirds, and, in lower third, by integument & fascia only on inner side of tendo Achillis.

Divides into the two plantar arteries midway between internal malleolus & heel, and between tendons of tibialis posticus & flexor longus digitorum, which are anterior & internal to it, and tendon of flexor longus pollicis, which lies posterior & external. Posterior tibial nerve is first posterior & internal to it, but soon crosses to its outer side.

BRANCHES:

Peroneal — Arises an inch below lower border of popliteus.

Downwards & outwards upon tibialis posticus & flexor longus pollicis & between fibres of latter muscle, and beneath soleus & deep layer of fascia, and ends on outer side of os calcis, joining with external malleolar & external plantar. Gives off branches:

MUSCULAR – To soleus & muscles of deep layer, and peronei.

NUTRIENT TO FIBULA – Downwards in nutrient canal towards lower extremity of the bone.

COMMUNICATING TO POST. TIBIAL – Inwards beneath flexor tendons a little above ankle joint.

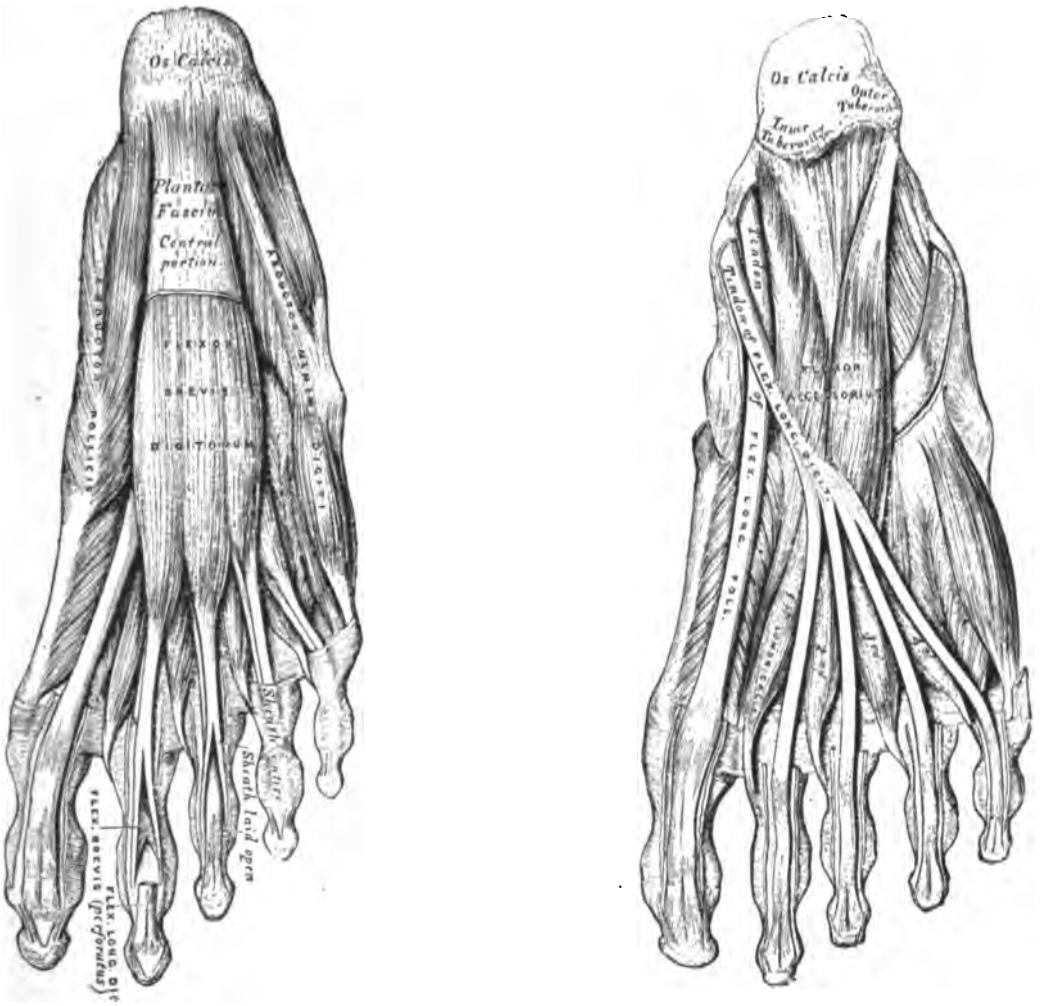
ANT. PERONEAL – The largest branch. Through interosseous membrane two inches above malleoli. Downwards beneath peroneus tertius to outer side of tarsus, and joins with external malleolar & tarsal.

Muscular — To soleus & muscles of deep layer.

Nutrient to Tibia — The largest of the nutrient arteries. – Downwards in nutrient canal towards lower extremity of the bone.

Communicating to Peroneal — Outwards beneath flexor tendons a little above ankle joint.

Internal calcanean — To integument & fat about tendo Achillis & heel.



FIGS. 251 & 252.—MUSCLES OF THE SOLE OF THE FOOT, FIRST AND SECOND LAYERS. (Gray.)

FIG. 253.—MUSCLES OF THE SOLE OF THE FOOT, THIRD LAYER. (Gray.)

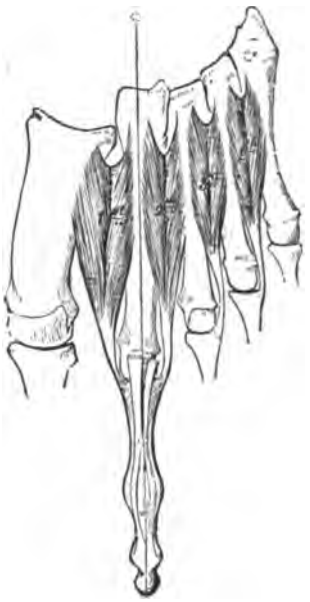


FIG. 254.—DORSAL INTEROSSEI. (Gray.)

FIG. 255.—PLANTAR INTEROSSEI. (Gray.)

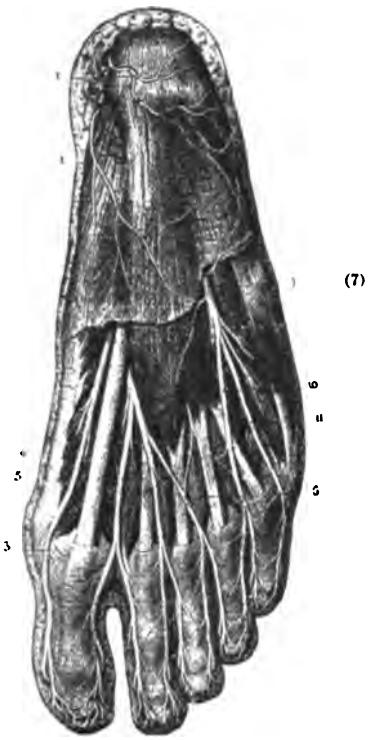


FIG. 256.—NERVES OF SOLE OF FOOT, SUPERFICIAL DISSECTION. (Hirschfeld.)

3, 4, 5, 6, 10, 11, the several digital nerves; 7, the external plantar nerve, just showing its division into superficial & deep branches; 1, plantar cutaneous nerve.

For further explanation of these Figs. see p. 96i.

It will be best to examine Fig. 257 in the light of Fig. 258, and Fig. 256 in the light of both the following figures.

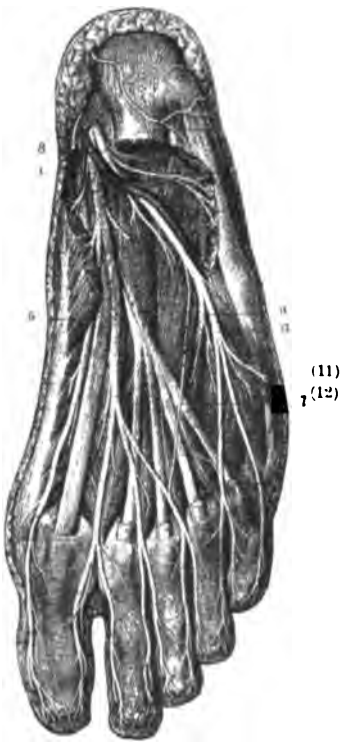


FIG. 257.—NERVES OF SOLE OF FOOT, MIDDLE DISSECTION. (Hirschfeld.)

1, internal plantar nerve; 8, external plantar nerve dividing into its deep & superficial branches, 11 and 12.

FIG. 258.—NERVES OF SOLE OF FOOT, DEEP DISSECTION. (Gray.)

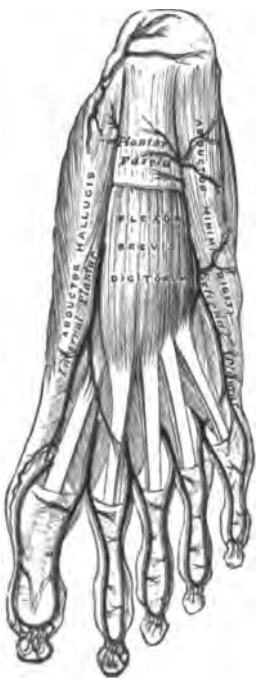


FIG. 259.—THE PLANTAR ARTERIES, SUPERFICIAL VIEW. (Gray.)

FIG. 260.—THE PLANTAR ARTERIES, DEEP VIEW. (Gray.)

POSTERIOR TIBIAL NERVE.

Commences at lower border of popliteus.
Beneath arch of soleus, superficial muscles, & deep layer of fascia to interval between inner malleolus & heel, where it divides into internal & external plantar.
Is first internal & posterior to posterior tibial vessels, but soon passes to their outer side. – Its branches are:
Muscular – To flexor longus pollicis, flexor longus digitorum, tibialis posticus.
Plantar Cutaneous – Perforates internal annular ligament to integument of heel & inner part of sole of foot.

MUSCLES of SOLE of FOOT.

FIRST LAYER.

Flexor Brevis Digitorum – Greater tuberosity of os calcis; central part of plantar fascia; intermuscular septa on either side.
Sides of second phalanges of four outer toes. – S. by int. plantar n.

Abductor Pollicis – Greater tuberosity of os calcis; internal annular ligament; intermuscular septum between it and flexor brevis digitorum.
Inner side of base of first phalanx of great toe. – S. by int. plantar n.

Abductor Minimi Digiti – Lesser tuberosity of os calcis, greater tuberosity in front of flexor brevis, and slightly from under surface of os calcis in front of tuberosities; plantar fascia; intermuscular septum between it & flexor brevis.
Outer side of base of first phalanx of little toe. – S. by trunk of external plantar nerve before its bifurcation.

SECOND LAYER.

Flexor Longus Digitorum.

Flexor Accessorius – Inner & under surfaces of os calcis by two heads which embrace the long plantar ligament.
Outer border and upper & under surfaces of tendon of flexor longus digitorum. – S. by trunk of external plantar nerve before its bifurcation.

Lumbricales – Tendons of flexor longus digitorum, the innermost from one, the others from two tendons.
Inner side of extensor tendons & inner side of bases of first phalanges of four outer toes. – S., the two inner ones by internal plantar nerve, the two outer ones by deep branch of external plantar.

Flexor Longus Pollicis.

THIRD LAYER.

Flexor Brevis Pollicis – By a tendinous process from adjoining borders of cuboid & external cuneiform, & from expansion of tendon of tibialis posticus.
Inner & outer sides of base of first phalanx of great toe, a sesamoid bone being developed in each tendon of insertion. – S. by int. plantar n.

Flexor Brevis Minimi Digiti – Base of 5th metatarsal bone & sheath of peroneus longus.
Outer side of base of first phalanx of little toe. – S. by superficial branch of external plantar nerve.

Adductor Pollicis – Bases of 2nd, 3rd, & 4th metatarsal bones & sheath of peroneus longus.
Outer side of base of first phalanx of great toe. – S. by deep branch of external plantar nerve.

Transversus Pedis – Head of 5th metatarsal bone & transverse ligament of the metatarsus.
Outer side of base of first phalanx of great toe. – S. by deep branch of external plantar nerve.

FOURTH LAYER.

Plantar Interossei – Three. Arise from lower or plantar half of inner side of shaft of 3rd, 4th, & 5th metatarsal bones, and are inserted into inner side of base of first phalanx of corresponding toes, & into the expansion of the corresponding long extensor tendon. – They adduct the toes towards the second toe. – S. by external plantar nerve.

Dorsal Interossei – Four. Arise from the adjacent sides of two metatarsal bones, as follows: – from the whole extent of the side of the metatarsal bone which corresponds to the toe into which the muscle is inserted inferiorly, from the upper or dorsal half only of the side of the other. They are inserted into the corresponding side of the base of the first phalanx of the toe to which they belong. – They are found on both sides of the 2nd toe and on the outer side of the 3rd & 4th toes. – They abduct therefore the three middle toes from an imaginary line drawn through the second toe. – S. by external plantar nerve.

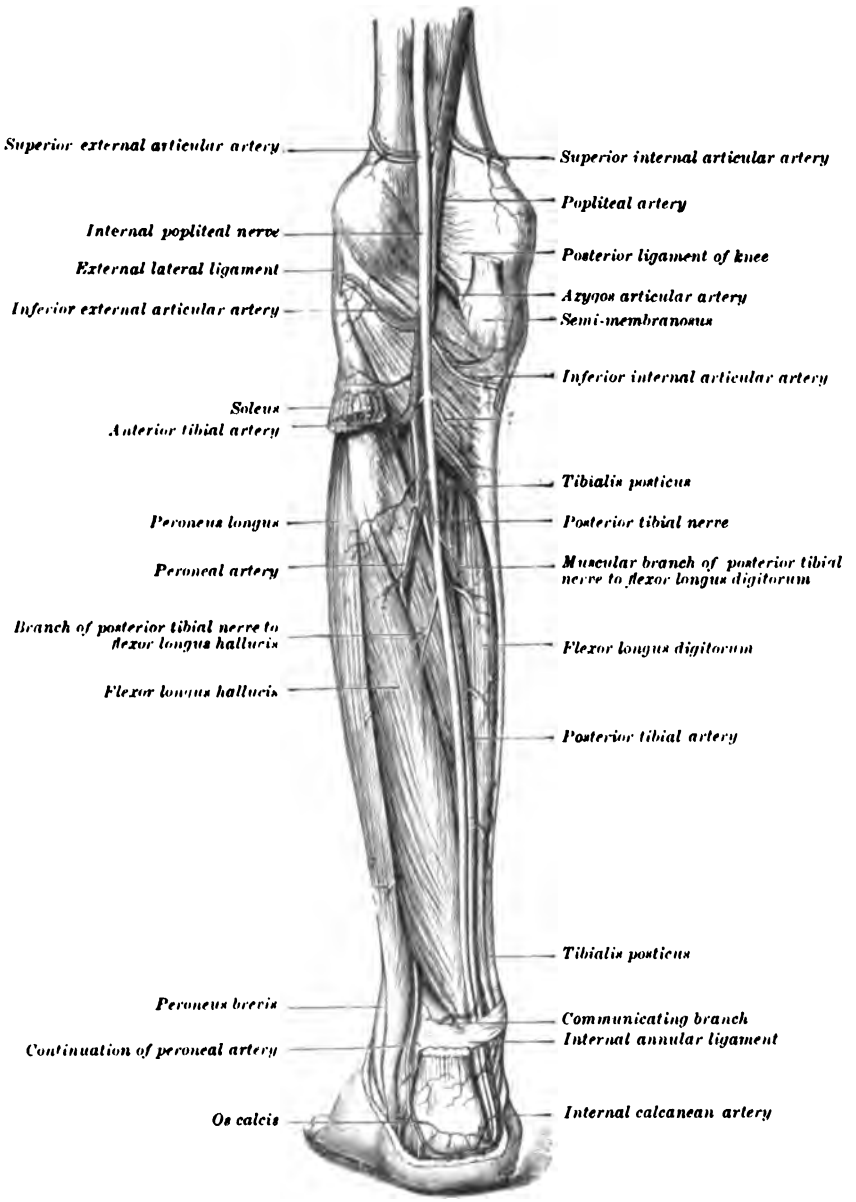
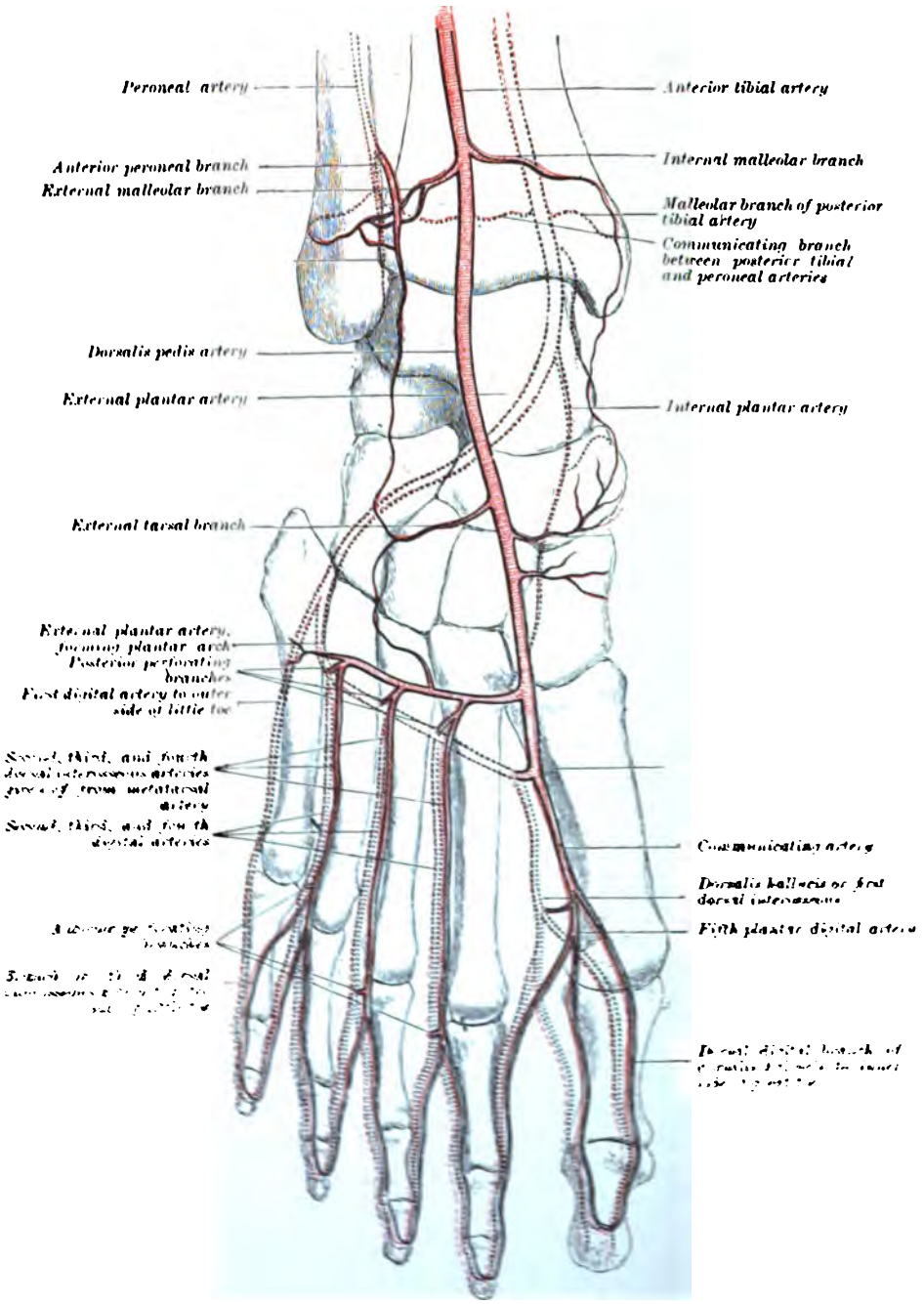


FIG. 201.—POPLITEAL, POSTERIOR TIBIAL AND PERONEAL ARTERIES. (Morris)


Peroneal artery
Anterior tibial artery
Anterior peroneal branch
External malleolar branch
Internal malleolar branch
Malleolar branch of posterior tibial artery
Communicating branch between posterior tibial and peroneal arteries
Dorsalis pedis artery
External plantar artery
Internal plantar artery
External tarsal branch
External plantar artery, forming plantar arch
Posterior perforating branches
First dorsal artery to outer side of little toe
Second, third, and fourth dorsal interosseous arteries
Second, third, and fourth digital arteries
Communicating artery
Dorsalis hallucis or first dorsal interosseous
Fifth plantar digital artery

THE PLANTAR ARTERIES

Branches of bifurcation of posterior tibial beneath internal annular ligament & origin of abductor pollicis.

INTERNAL PLANTAR — The smaller.

Forwards between abductor pollicis & flexor brevis digitorum, and ends at extremity of first metatarsal bone in a small branch which runs along inner border of great toe, and joins with the corresponding plantar digital artery from communicating branch of dorsalis pedis.

EXTERNAL PLANTAR — The larger.

Outwards between flexor brevis digitorum & flexor accessorius, and then forwards between former muscle & abductor minimi digiti as far as base of 5th metatarsal bone.

Round outer border of flexor accessorius, and inwards upon interossei & bases of the metatarsal bones, -beneath adductor pollicis, flexor tendons & lumbricales,- to back of first interosseous space, where inosculates with communicating branch of dorsalis pedis, thus completing plantar arch.

BRANCHES:

Posterior perforating — Three - Through back part of three outer interosseous spaces, and inosculate with dorsal interosseous branches from metatarsal.

Plantar interosseous (DIGITAL) — Four. Forwards upon interosseous spaces (outermost crossing under surface of 5th metatarsal bone under cover of abductor & flexor brevis minimi digiti), and supply plantar digital branches to 3½ toes on outer side of foot. The three innermost give off the

ANT. PERFORATING ARTERIES - Three. Through anterior part of three outer interosseous spaces, and inosculate with the dorsal interosseous branches from metatarsal just before they bifurcate.

Talipes.

Talipes. Equinus – Heel drawn up
" Calcaneus – Reverse
" Planus – Sole drop too much
" Cavus – " too much up
" Valgus (out) – " out
" Varus (in) – " in

(Word "out" has more letters than word "in" so has Valgus as ... Varus)
Equino-varus – most common.
Calcaneo-valgus – next most "
Ant. poliomyelitis most common cause of acquired club-foot due to paralysis of muscles –
Muscles of parts

In Equinus { Gastrocnemius, Soleus, Plantaris
" Calcaneus { Ex. long. digit., " prop. hallucis, Tibialis anticus, Peroneus tertius
In Varus { Tibialis Posticus, " anticus, Long flexor of toe, Possibly " extensor of toe
In Valgus { Peronei

THE PLANTAR NERVES.

Internal Plantar Nerve – The larger. With internal plantar artery between abductor pollicis & flexor brevis digitorum, and divides into four digital branches to 3½ toes on inner side of foot. Supplies flexor brevis digitorum, abductor & flexor brevis pollicis, two inner lumbricales, integument of sole of foot & articulations of tarsus; joins with external plantar.

External Plantar Nerve – The smaller. With external plantar artery between flexors accessorius & brevis, and then between flexor brevis & abductor minimi digiti; supplies the first & the last of these muscles, and divides into:

SUPERFICIAL BRANCH – Supplies 1½ toes on outer side of foot, flexor brevis minimi digiti & interossei of 4th space; joins with internal plantar.

DEEP BRANCH – Accompanies plantar arch; supplies remaining interossei & lumbricales, adductor pollicis, & transversus pedis.

Blood supply of Hand ? = from

Foot = Hand

Post. Carpal = Ulnar

Ant. Carpal = Radial

Digital (small) } = (Ulnar, Radial, & Deep Palmar Arch)
" (Index) } = (Deep Palmar Arch & Princeps Pollicis)

Plantar = Deep (Calcaneal, Anterior Tibial)

Princeps Pollicis } = (Radial & Deep Palmar Arch)
Radialis Indicis }

Peroneal ? Sole
Anterior Tibial
Posterior Tibial } = (Plantar & Malleolar Arches)
Anterior Tibial
3½ Outer Malleolus

3½ Outer Malleolus

LOWER LIMB.

V.

MUSCULAR ATTACHMENTS.

ARTICULATIONS.

MUSCULAR ATTACHTS. of BS. of LOWER LIMB—1st T.

The muscules attached to the

MINATE BONE — Are thirty-two in number, and are attached as follows: -

Ilium - Thirteen: -

Gluteus Maximus - Superior curved line on dorsum ilii and rough surface between it & posterior fifth of crest.
Gluteus Medius - Dorsum ilii & outer lip of crest between superior & middle curved lines.
Gluteus Minimus - Dorsum ilii between middle & inferior curved lines.
Rectus Femoris (Reflected Tendon) - Groove above brim of acetabulum.
(Straight Tendon) - Anterior inferior spine.
Iliacus - Iliac fossa & inner lip of crest.
Sartorius - Anterior superior spine & upper half of notch below it.
Tensor Vaginæ Femoris - Anterior superior spine & anterior fifth of outer lip of crest.
Obliquus Externus - Anterior half of outer lip of crest.
Latissimus Dorsi - Posterior half of outer lip of crest.
Internal Oblique - Anterior two-thirds of middle lip of crest.
Transversalis - Anterior three-fourths of inner lip of crest.
Quadratus Lumborum - Posterior part of inner lip of crest for about two or three inches in front of erector spinæ
Erector Spinæ - Posterior superior spine & posterior fifth of inner lip of crest.

Ischium - Fourteen: -

Gracilis - Inner margin of ascending ramus.
Adductor Magnus - Ascending ramus & outer side of tuberosity.
Obturator Externus - Circumference of obturator foramen.
Transversus Perinæi - Inner & fore part of tuberosity.
Erector Penis or Clitoridis - Pubic arch & fore part of inner side of tuberosity.
Obturator Internus - Whole of inner surface of true pelvis in front of and behind obturator foramen.
Gemellus Superior, *Levator Ani*, *Coccygeus* - Spine.
Gemellus Inferior - Upper part of outer lip of tuberosity.
Quadratus Femoris - Whole length of outer lip of tuberosity.
Biceps (Long Head) - Lower & inner of the two surfaces on back part of tuberosity.
Semitendinosus - Lower & inner of the two surfaces on back part of tuberosity.
Semimembranosus - Upper & outer of the two surfaces on back part of tuberosity.

Pubes - Twelve: -

Pectineus - Ilio-pectineal line & surface in front of it.
Adductor Longus - Front of body immediately below the crest & close to angle.
Adductor Brevis - Front of body for about two inches below adductor longus & between gracilis & obturator externus.
Adductor Magnus - Lower part of descending ramus.
Gracilis - Inner margin of ramus & lower half of inner margin of body.
Obturator Externus - Circumference of obturator foramen.
Obturator Internus - Whole of inner surface of true pelvis in front of & behind obturator foramen.
Rectus abdominis, *Pyramidalis*, *Conjoined Tend. of Int. Oblique & Transv.* - Crest.
Levator Ani - Back of body.

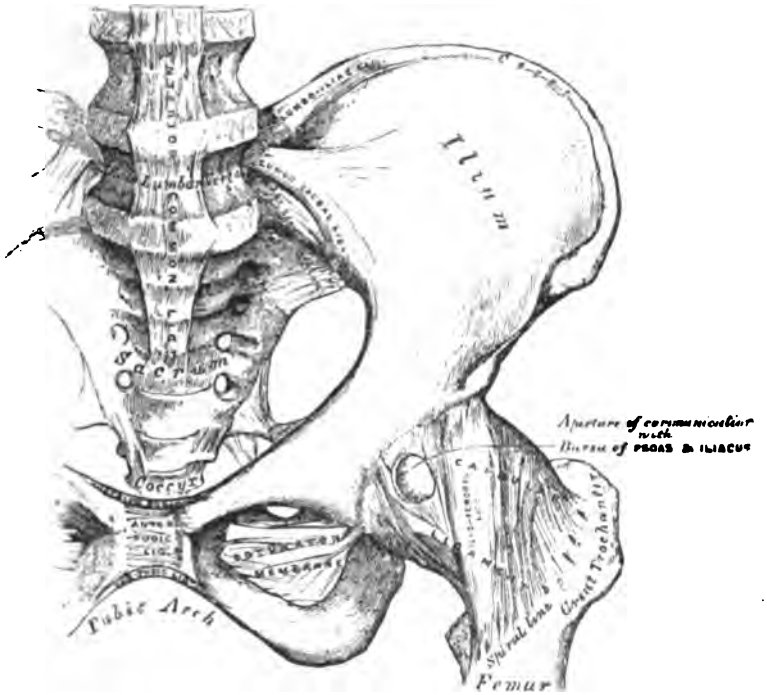


FIG. 263.—HIP-JOINT, ANTERIOR VIEW. (Gray.)

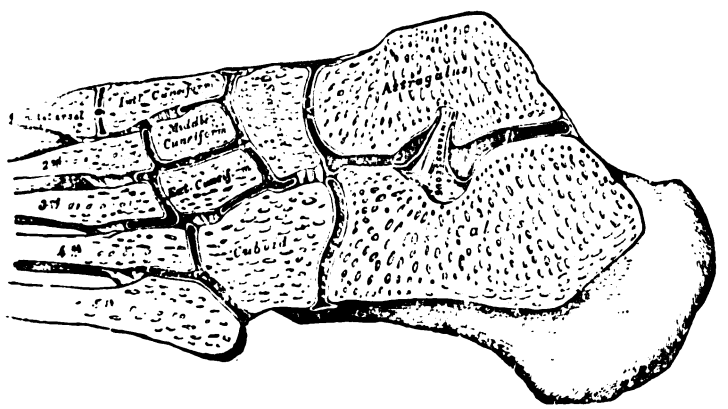


FIG. 264.—SYNOVIAL MEMBRANES OF THE TARSUS AND METATARSUS. (Gray.)

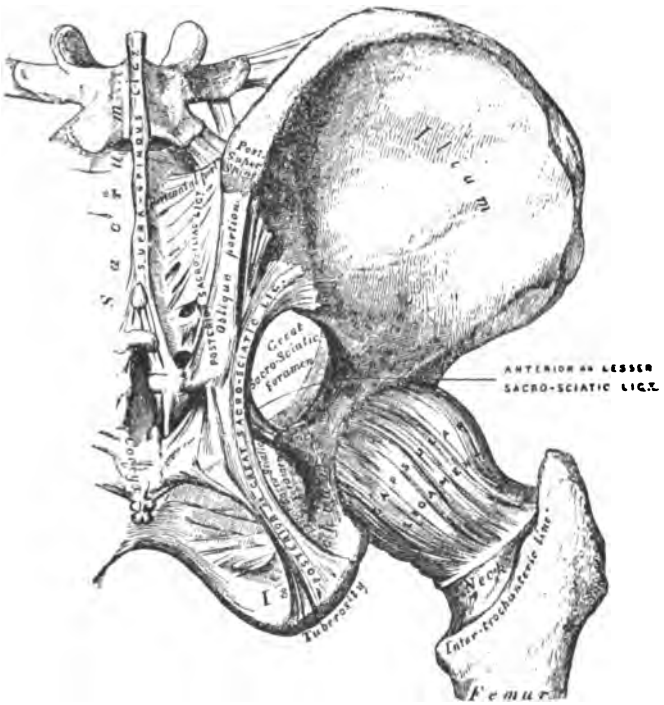


FIG. 265.– HIP-JOINT, POSTERIOR VIEW. (Gray.)

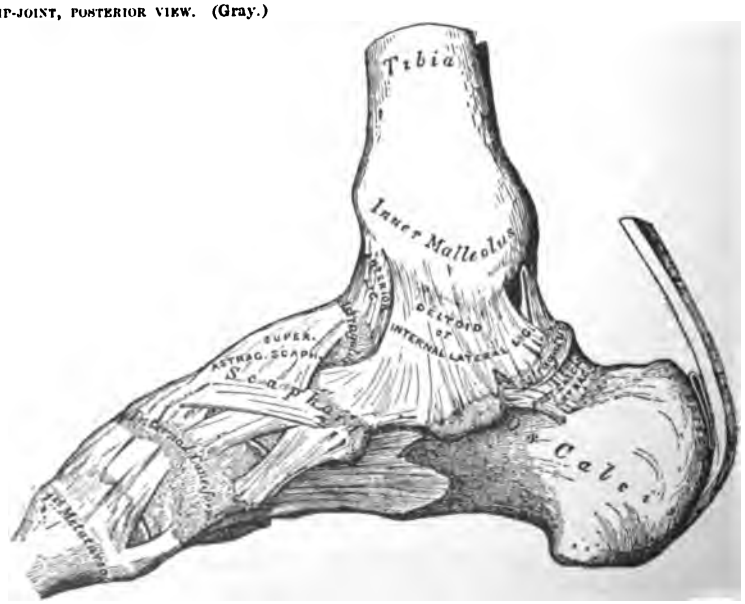


FIG. 266.– RIGHT ANKLE-JOINT: TARSAL AND TARSO-METATARSAL ARTICULATIONS, INTERNAL VIEW. (Gray.)

MUSCULAR ATTACHTS. of BS. of LOWER LIMB—2nd T

The muscules attached to the

FEMUR — Are twenty-four in number, and are attached as follows: -

Vastus Externus - Anterior border of great trochanter & horisontal ridge on its outer surface; rough line from great trochanter to linea aspera; whole length of outer lip of linea aspera and line from linea aspera to outer condyle.

Vastus Internus - Line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; inner surface.

Crureus - Anterior & outer surfaces from anterior intertrochanteric line to within a few inches of condyles.

Taking the vastus internus & the crureus as forming but one muscle, and describing the *Quadriceps extensor femoris* as a *Triceps*, we may say that the "VASTUS INTERNUS" arises from: - line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; nearly whole of *inner*, *anterior* and *outer* surfaces of shaft of femur.

Subcrureus - Lower part of anterior surface.

Psoas Magnus - Lesser trochanter.

Iliacus - Upper part of line from trochanter minor to linea aspera in front of pectineus.

Pectineus - Upper part of line from trochanter minor to linea aspera, & into the bone behind trochanter minor.

Adductor Longus - Middle third of inner lip of linea aspera between vastus internus & adductor magnus.

Adductor Brevis - Upper part of linea aspera & lower part of line from it to lesser trochanter below & behind pectineus.

Adductor Magnus - Lower part of line from great trochanter to linea aspera, whole length of inner lip of linea aspera & line from it to inner condyle; by a strong tendon into tubercle at upper & back part of inner condyle.

Biceps (Short Head) - Whole length of outer lip of linea aspera between adductor magnus & vastus externus, and from inferior external division of linea aspera to within two inches of outer condyle.

Gluteus Maximus - Rough line from great trochanter to linea aspera.

Gluteus Medius - Oblique line on outer surface of great trochanter.

Gluteus Minimus - Anterior border of great trochanter.

Pyriformis - Posterior part of upper border of great trochanter.

Obturator Internus - Upper border of great trochanter in front of pyriformis.

Gemellus Superior. } Indirectly, by joining tendon of foregoing.
Gemellus Inferior. }

Quadratus Femoris - Upper part of linea quadrati on back of great trochanter.

Obturator Externus - Digital fossa.

Gastrocnemius - Depressions at upper and back part of condyles, and lower part of the two inferior divisions of linea aspera.

Plantaris - Lower part of outer division of linea aspera.

Popliteus - Anterior & deepest part of groove on outer side of outer condyle of femur below tubercle for external lateral ligament of knee-joint.

Semimembranosus - Posterior & upper part of outer condyle.

Great Sacro-iliac ligament in standing position of body.
Sacro-iliac ligament prevents sacrum from falling.

MUSCULAR ATTACHTS. of BS. of LOWER LIMB—3rd T.

The muscular attached to the

TIBIA — Are ten in number, and are attached as follows: –

Tibialis Anticus – Outer tuberosity & upper two-thirds of outer surface of shaft
Extensor Longus Digitorum – Outer tuberosity.
Sartorius – Upper part of inner surface of shaft covering tendons of gracilis & semitendinosus.
Gracilis – Upper part of inner surface of shaft above semitendinosus, and beneath sartorius.
Semitendinosus – Upper part of inner surface of shaft below gracilis & beneath sartorius.
Semimembranosus – Posterior part of inner tuberosity; groove on inner side of inner tuberosity.
Popliteus – Inner two-thirds of triangular surface on back of upper part of shaft.
Soleus – Middle third of inner border, and oblique line on posterior surface of shaft.
Flexor Longus Digitorum – Posterior surface of shaft below oblique line & internally to attachment of tibialis posticus.
Tibialis Posticus – Posterior surface of shaft below oblique line & externally to attachment of flexor longus digitorum.

FIBULA — Are nine in number, and are attached as follows: –

Extensor Longus Digitorum – Upper three-fourths of anterior surface of shaft.
Extensor Proprius Pollicis – Middle two-fourths of anterior surface of shaft internally to extensor longus digitorum.
Peroneus Tertius – Lower fourth of anterior surface of shaft.
Peroneus Longus – Head & upper two-thirds of outer surface & of anterior & posterior borders.
Peroneus Brevis – Lower two-thirds of outer surface of shaft, passing upwards in a pointed process beneath peroneus longus.
Biceps – Outer side of head.
Soleus – Back of head & upper third of posterior surface of shaft.
Flexor Longus Pollicis – Lower two-thirds of posterior surface of shaft.
Tibialis Posticus – Upper three-fourths of inner surface of shaft.

THE HIP-JOINT.

Is *the* typical enarthrodial articulation.

ARTICULAR SURFACES:

Acetabulum – Deep, hemispherical, further deepened in the fresh condition by the cotyloid & transverse ligaments. Looks downwards, outwards & forwards. Is divided into:
INCOMPLETE ARTICULAR RING – Broadest above & behind, and deficient below & in front.
CENTRAL NON-ARTICULAR DEPRESSION – Continuous with cotyloid notch; lodges a mass of fat, which forms a bed for the round ligament.

Head of Femur – Forms nearly two-thirds of a sphere, and, in the normal position of the limb, looks upwards, inwards & forwards. It presents a little below & behind its centre a small circular depression for attachment of ligamentum teres; near this depression the cartilage is thicker than elsewhere.

LIGAMENTS — Are: –

Capsular – Short & thick, especially above & in front; thinner & looser below & behind; sometimes perforated beneath psoas. – It extends from
Outer lip of margin of acetabulum within two or three lines of the cotyloid ligament, and, opposite the cotyloid notch, from transverse ligament & edge of obturator foramen to
Anterior intertrochanteric line in front; base of neck of femur, above; and, behind, to back of neck of femur, within about half an inch from lesser trochanter & posterior intertrochanteric line.

Ilio-Femoral or Accessory – A thickened band closely connected with front of capsule, which extends obliquely from
Anterior inferior spine of ilium to
Lower part of anterior intertrochanteric line.
There are also several other accessory bands, viz., one on the outer side of the ilio-femoral termed the *Ilio-trochanteric*, one on the inner side of the ilio-femoral termed the *Pubo-femoral*; also a transverse band at the back of the joint.

Round Ligament or Ligamentum Teres – Interarticular band about an inch long and of very variable strength & thickness, attached, on the one hand, to
Depression a little below & behind centre of head of femur, and on the other hand, dividing into two fasciculi, to
Margins of cotyloid notch; the two fasciculi blending with the transverse ligament. It conveys a few vessels to head of femur.

Cotyloid – Incomplete fibro-cartilaginous ring triangular on section, presenting a base attached to margin of acetabulum, and a sharp free edge which closely embraces head of femur. It is thickest above & behind, and deficient opposite the cotyloid notch, where it is continued into the transverse ligament. It consists of closely interlaced oblique fibres arising from the different points of the rim of the bone.

Transverse – Strong flattened band, a continuation of the foregoing, which extends from one side of the cotyloid notch to the other, transforming it into a complete foramen.

SYNOVIAL MEMBRANE — Invests whole of anterior surface & greater part of posterior surface of neck of femur, cotyloid ligament, mass of fat at bottom of acetabulum, & ligamentum teres. – It communicates sometimes through a small opening in the capsule with the bursa beneath psoas & iliacus.

VASCULAR & NERVE SUPPLY — From obturator, sciatic & internal circumflex arteries, and from great sciatic, obturator & accessory obturator nerves.

MOVEMENTS — Are flexion, extension, adduction, abduction, rotation & circumduction. –

Flexion is freer than extension: the thigh can be brought forwards till it touches the abdomen, but it cannot be carried backwards to anything like the same extent. Flexion, in fact, is scarcely interfered with by the posterior part of the capsule, which is thin & loose; extension, on the contary, is soon arrested by the ilio-femoral ligament and by the anterior part of the capsule, which is short & thick. –

Of the two lateral movements abduction is the freest; it is checked by the action of the pubo-femoral band. Adduction is checked mainly by the two limbs coming in contact, but also partly by the action of the ilio-trochanteric band. When however flexion & adduction are combined, so that one limb passes in front of the other, the double movement may be carried very far; it is at last arrested, by the action of the round ligament. The round ligament is also tensed when flexion & abduction are combined and carried to a considerable extent, and when the limb is rotated outwards.

Rotation inwards is freer than rotation outwards (rotation being measured from the intermediate position which the foot normally occupies in standing); this is partly due to the greater laxity of the capsule behind than in front, and partly also to the direction forwards both of the head of the femur & of the acetabulum. Rotation takes place round an imaginary line extending from the head of the femur to the centre of the knee-joint. – Circumduction, as all other movements generally, is much less free in the hip than in the shoulder-joint.

The weight of the limb at the hip-joint is normally supported by atmospheric pressure: – In consequence of the complete exclusion of air from the joint through the accurate adaptation of the cotyloid & transverse ligaments to the head of the femur, the latter is firmly retained in the acetabulum even after all the soft parts around the joint have been divided. If air be allowed to penetrate into the joint through a perforation of the acetabulum from within, the limb will immediately

KNEE-JOINT—3rd Tablet.

LIGAMENTS — Are the: -

Anterior Ligament or Ligamentum Patellæ - Strong flat band about three inches long, a continuation of tendon of rectus femoris, which extends from
Apex of patella & rough depression below its articular surface to
Lower part of tubercle of tibia, being separated from upper part of the tubercle by a small bursa. - It is separated from the synovial membrane of the knee-joint by a considerable mass of adipose tissue.

Posterior Ligament - Consists of three portions (Cruveilhier, Gray): -

CENTRAL PORTION OR LIGAMENTUM POSTICUM WINSLOWII (The only portion described either by Winslow, or by Heath, Quain, & many modern Authors) - Broad flat band partly derived from tendon of semimembranosus, and which extends obliquely from
Back part of inner tuberosity of tibia to
Upper & back part of outer condyle of femur.

TWO LATERAL PORTIONS (CAPSULE FIBREUSE DES CONDYLES, Cruveilhier) - Closely connected with tendons of gastrocnemius, popliteus, plantaris, and formed chiefly of vertical fibres extending from
Condyles just above their articular surfaces to
Back of head of tibia. - These lateral portions are looked upon by many anatomists as a part of the capsular ligament.

Internal Lateral Ligament - Broad flat band from
Back part of inner tuberosity of femur to
Inner tuberosity & upper part of inner surface of shaft of tibia. - Covers anterior portion of tendon of semimembranosus & inferior internal articular vessels, and is covered by tendons of sartorius, gracilis & semitendinosus, a bursa being interposed.

External Lateral Ligament - Consists of two portions: -

LONG EXTERNAL LATERAL LIGAMENT - Strong rounded cord from
Back part of outer tuberosity of femur to
Outer part of head of fibula. - It is embraced by the two fasciculi into which the tendon of the biceps divides, and beneath it pass tendon of popliteus & inferior external articular vessels.

SHORT EXTERNAL LATERAL LIGAMENT - Accessory & somewhat variable bundle of fibres intimately blended with capsule, lying behind foregoing & on outer side of tendon of popliteus, and extending from
Lower & back part of outer tuberosity of femur to
Apex of styloid process of fibula.

Capsular Ligament - Lies in contact with the synovial membrane, and beneath the other ligaments, which it binds together. It is strengthened by expansions from the fascia lata and from the vasti, biceps, sartorius & semimembranosus; the expansions from the fascia lata & the vasti forming, on either side of the patella, the so-called *lateral patellar ligaments.* It is attached to
Femur just above the articular surfaces,
Upper border & sides of patella,
Margins of head of tibia & semilunar fibro-cartilages.

Crucial Ligaments - Two, project into the interior of the joint from behind, and cross each other obliquely like the bars of an X,

ANTERIOR CRUCIAL LIGAMENT - The most oblique & somewhat the smaller, from
Inner part of rough triangular depression in front of spine of tibia between points of attachment of anterior extremities of both semilunar fibro-cartilages, and partly also from anterior extremity of the external semilunar fibro-cartilage itself to
Inner & back part of outer condyle of femur.

POSTERIOR CRUCIAL LIGAMENT - The thickest & strongest. Nearly vertically from
Back part of rough depression behind spine of tibia, behind points of attachment of posterior extremities of both semilunar fibro-cartilages, and partly from posterior extremity of external semilunar fibro-cartilage itself to
Anterior & outer part of inner condyle of femur & front of intercondyloid notch.

Transverse & Coronary Ligaments -

Ligamentum Mucosum & Ligamenta Alaria -

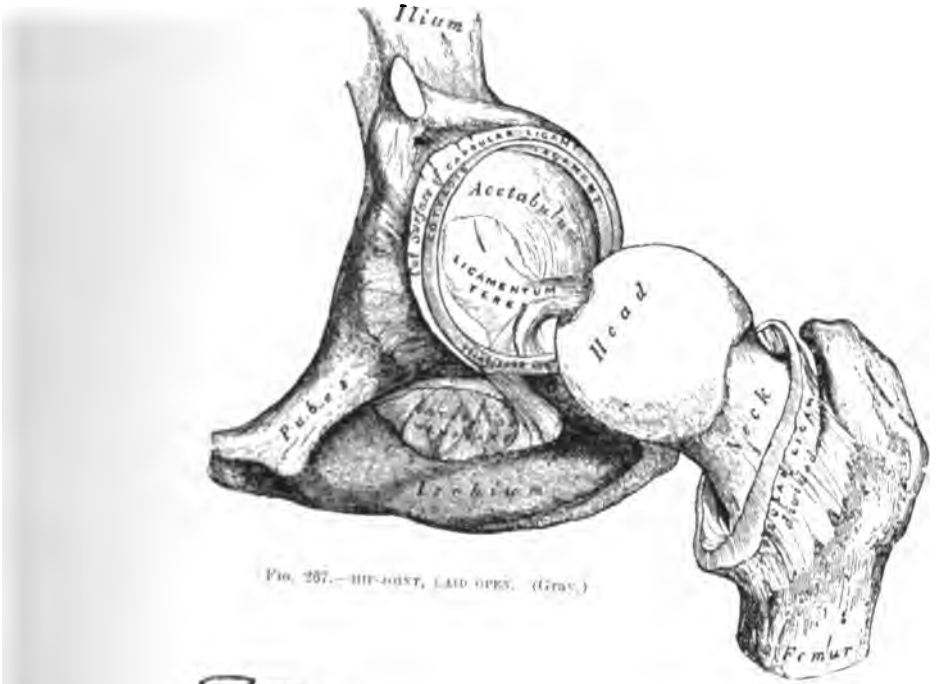


FIG. 287.—HIP-JOINT, LAID OPEN. (Gray.)

FIG. 288.—RIGHT ANKLE-JOINT: TARSAL AND TARSO-METATARSAL ARTICULATIONS, EXTERNAL VIEW. (Gray.)

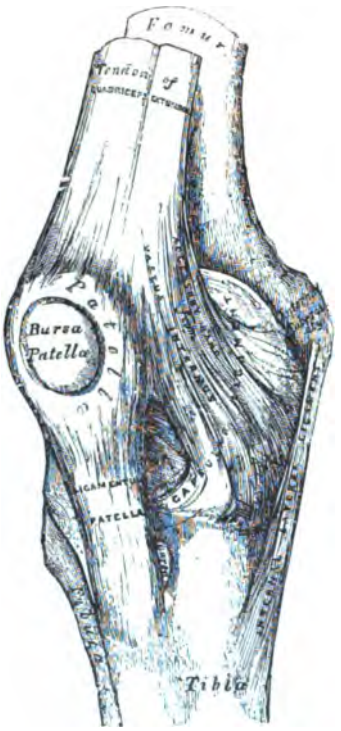


FIG. 269.—RIGHT KNEE-JOINT, ANTERIOR VIEW. (Gray).

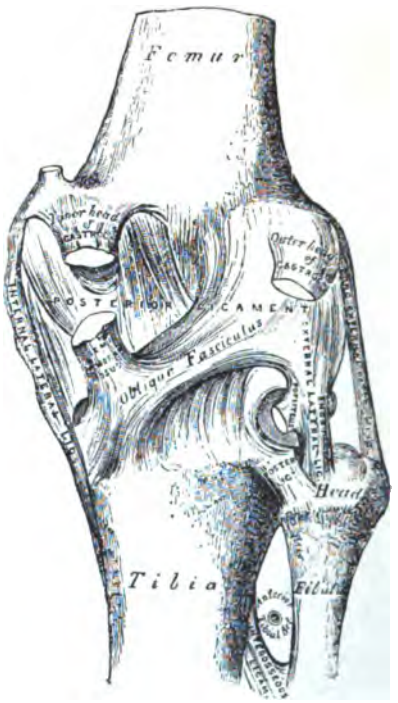


FIG. 270.—RIGHT KNEE-JOINT, POSTERIOR VIEW. (Gray.)

THE ANKLE-JOINT.

Is a ginglymoid articulation.

ARTICULAR SURFACES: -

The Trochlea - Is formed by the upper articular surface & the two lateral facets of the astragalus. The upper articular surface is broadest in front, convex from before backwards, & slightly concave from side to side; its outer border is a little longer than the inner one, and is slightly curved inwards posteriorly. Of the two lateral facets, the external one is the largest.

The Receiving Cavity - Is formed by the under surface of the lower extremity of the tibia, and by the outer & inner surfaces respectively of the internal & external malleoli. The under surface of the lower extremity of the tibia is quadrilateral, broadest in front, concave from before backwards, and marked by a slight antero-posterior elevation separating two shallow lateral depressions. Of the articular facets of the two malleoli, that of the outer one is the largest.

LIGAMENTS — Are: -

Anterior & Posterior - Very thin, especially the posterior one, and consisting merely of a few scattered fibres extending between the tibia & the astragalus at the margin of their articular surfaces. - The fibres of the posterior ligament are mainly transverse.

S C A **Internal Lateral** - Consists of two layers: -

SUPERFICIAL LAYER, OR DELTOID LIGAMENT - Strong triangular band, which radiates from

Apex and anterior & posterior borders of internal malleolus to
Inner part of scaphoid & inferior calcaneo-scaphoid ligament; lesser process of os calcis; and back part of inner surface of astragalus.

DEEP LAYER (Cruveilhier, Gray) - Short thick vertical band from
Apex of internal malleolus to
Inner surface of astragalus below its articular facet.

A C A **External Lateral** - Consists of three separate fasciculi: -

ANTERIOR FASCICULUS - Short, thick, nearly horizontally from
Anterior border of external malleolus to
Astragalus in front of its external articular facet.

MIDDLE FASCICULUS - Longer, rounded, from
Apex of external malleolus to
Middle of outer surface of os calcis.

POSTERIOR FASCICULUS - The strongest, deeply situated; nearly horizontally from
Depression at inner & back part of external malleolus to
Astragalus behind its external articular facet as far as groove for flexor longus pollicis.

SYNOVIAL MEMBRANE - Communicates with that of the inferior tibio-fibular articulation.

VASCULAR & NERVE SUPPLY — From the malleolar branches of the anterior tibial and the termination of the anterior peroneal, and from the anterior tibial nerve.

MOVEMENTS — Are flexion & extension with a slight amount of lateral mobility in the extended position. - In the flexed position the wide anterior part of the trochlea lies in the narrow posterior part of the receiving cavity, and the posterior fibres of the lateral ligaments are on the stretch; all lateral movement is then impossible. In the extended position the narrow posterior part of the trochlea lies in the wide anterior part of the receiving cavity, and, the lateral ligaments being relaxed (except in forced extension), a considerable amount of lateral movement is permitted: - Adduction is produced by the tibialis anticus, abduction by the peronei. In forced extension, however, the anterior fibres of the lateral ligaments become tensed, and movement from side to side is again prohibited. - Forced extension is accompanied by a slight amount of adduction in consequence of the outer border of the trochlea being a little longer than the inner one and slightly curved inwards posteriorly.

FASCIÆ & SYNOVIAL MEMBRANES of the TARSUS.

FASCIÆ — Are rather ligaments than fascia proper, and are therefore described here.

Anterior Annular Ligament – Consists of two portions connected by a thin intervening layer of fascia

SUPERIOR OR VERTICAL PORTION – Of considerable breadth & continuous superiorly with deep fascia of leg. It extends from lower part of anterior border of tibia to lower part of anterior border of fibula.

INFERIOR OR HORIZONTAL PORTION. – Narrower and continuous anteriorly with deep fascia over dorsum of foot. It extends from upper surface of os calcis, in front of groove for interosseous calcaneo-astragaloid ligament, to internal malleolus & inner border of plantar fascia.

Beneath anterior annular ligament pass from within outwards: –

1. – *Tendon of tibialis anticus* contained throughout in a synovial sheath.
2. – *Tendon of extensor proprius pollicis* contained in a synovial sheath beneath the inferior or horizontal portion of the ligament only.
3. – *Anterior tibial vessels & nerve.*
4. – *Tendons of extensor longus digitorum & peroneus tertius* enclosed throughout in one synovial sheath.

Internal Annular Ligament – Strong fibrous band continuous superiorly with deep fascia of leg, and giving origin inferiorly to innermost fibres of abductor pollicis. It extends obliquely from internal malleolus to inner surface of os calcis. Beneath it pass from before backwards & outwards: –

1. – *Tendon of the tibialis posticus* contained in a synovial sheath.
2. – *Tendon of the flexor longus digitorum* contained in another synovial sheath.
3. – *Posterior tibial vessels & nerve.*
4. – *Tendon of the flexor longus pollicis* also contained in a synovial sheath, and situated at a considerable depth in a groove on posterior surface of astragalus.

External Annular Ligament – Narrower & thinner band extending from external malleolus to outer surface of os calcis, and beneath which pass *Tendons of peronei* both enclosed in one synovial sheath.

SYNOVIAL MEMBRANES — Are articular & tendinous.

Articular – Six: –

1. – *Synovial membrane of posterior calcaneo-astragaloid articulation.*
2. – *Synovial membrane common to the anterior calcaneo-astragaloid & astragalo-scaphoid articulations.*
3. – *Synovial membrane of calcaneo-cuboid articulation.*
4. – *General synovial membrane of the tarsus* comprised between the scaphoid & the three cuneiform bones, between the three cuneiform bones, between the external cuneiform bone & the cuboid, between the middle & external cuneiform bones on the one hand and the bases of the 2nd & 3rd metatarsal bones on the other, between the bases of the 2nd & 3rd metatarsal bones. – Sometimes there is a separate synovial membrane between the scaphoid & the cuboid.
5. – *Synovial membrane of the articulation between the cuboid and the 4th & 5th metatarsal bones.*
6. – *Synovial membrane of the articulation between the first cuneiform bone & the first metatarsal.*

Tendinous – Vide Annular Ligaments.

FIG. 270A.—HEAD OF RIGHT TIBIA, WITH SEMILUNAR CARTILAGES. (Gray.)

FIG. 270B.—RIGHT KNEE-JOINT, SHOWING INTERNAL LIGAMENTS. (Gray.)

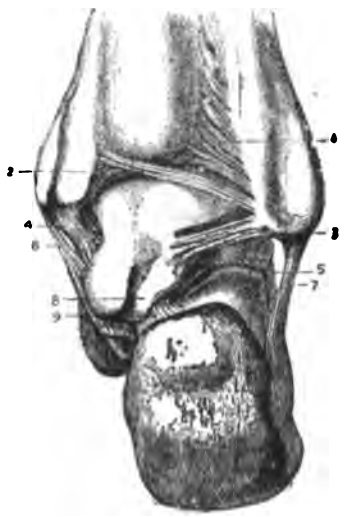


FIG. 270C.—POSTERIOR VIEW OF ANKLE-JOINT. (Sappey, Heath)

1, post. inf. tibio-fibular lgt.; 2, transverse lgt.; 3, post. fasc. of ext. lateral lgt.; 4, 6, int. lateral lgt.; 5, ext. calc.-astrag. lgt.; 7, mid. fasc. of ext. lateral lgt.; 8, groove for flex. long. pollicis; 9, post. calc.-astrag. lgt.

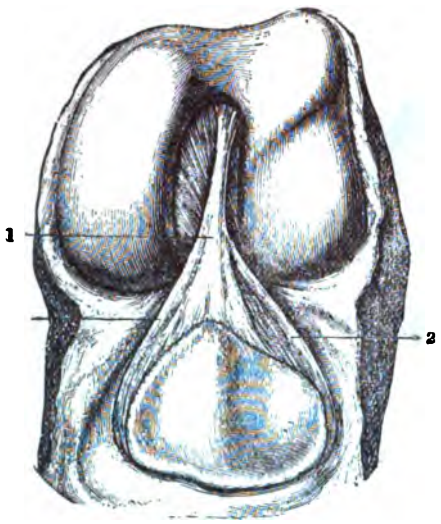


FIG. 270D.—THE KNEE-JOINT OPEN, SHOWING LIGAMENTUM MUCOSUM (1) AND THE LIGAMENTA ALARIA (2). (Morris.)

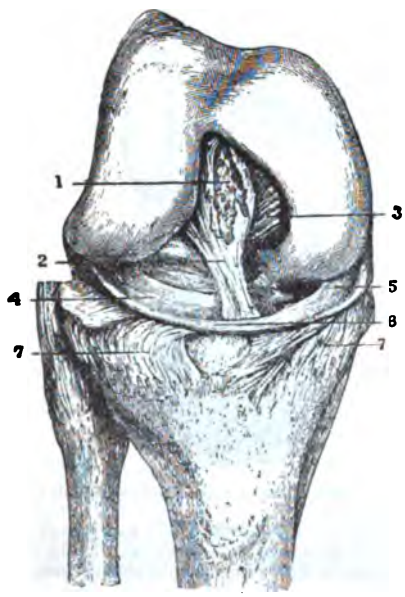


FIG. 270E.—THE KNEE-JOINT OPEN, SHOWING THE DEEPER INTERNAL LIGAMENTS. (Morris.)

1, fatty tissue within cut edge of ligamentum mucosum; 2, anterior crucial ligament; 3, posterior crucial ligament; 4, external semilunar cartilage; 5, internal semilunar fibro-cartilage; 6, transverse ligament; 7, 7, coronary ligament.

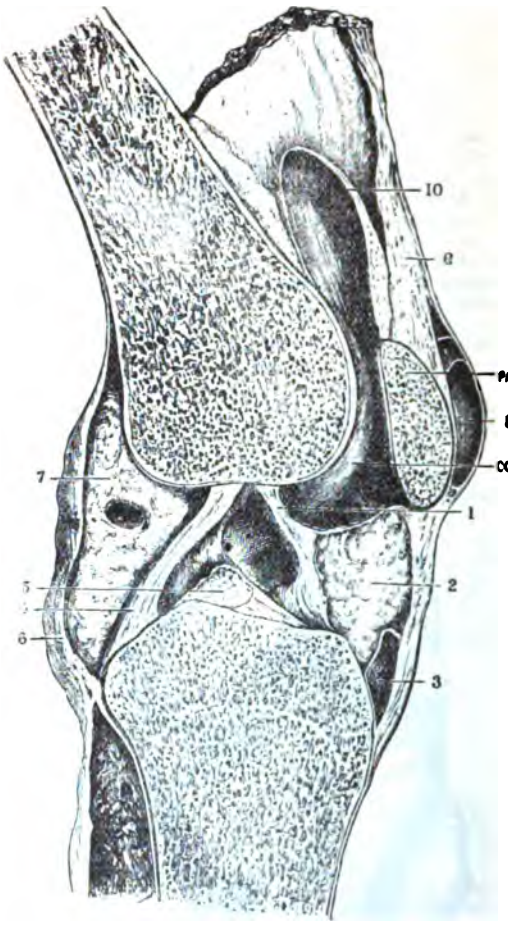


FIG. 270F.—SAGITTAL SECTION THROUGH INNER CONDYLE. (Morris.)

1, ligamentum mucosum; 2, 3, fatty tissue and bursa behind ligamentum patellæ; 4, posterior crucial ligament; 5, divided anterior crucial ligament; 6, posterior ligament; 7, fatty tissue; 8, pre-patellar bursa; 9, tendon of triceps, 10, upper extension of synovial membrane.

NOTES ON THE NEWER MATTER.

Adductor Obliquus Hallucis. - Adductor Transversus Hallucis.

These are simply new names for the "Adductor Pollicis Pedis" and the "Transversus Pedis."

A new muscle of the little toe is described by Prof. Macalister, the "*Opponens Minimi Digiti.*" It lies beneath and internal to the Flexor Brevis Minimi Digiti. It arises from the sheath of the peroneus longus and from the ligaments beneath the heads of the fourth and fifth metatarsal bones, and is inserted into the anterior half of the under surface of the fifth metatarsal bone. Its nerve-supply is the same as that of the Flexor Brevis. By Prof. Thane this new muscle is considered as merely a portion of the Flexor Brevis Minimi Digiti, "the deeper fibres of which end, in most cases, on the distal half of the shaft of the fifth metatarsal bone."

The Adductor Hallucis has frequently an additional origin from the tubercle of the scaphoid and from the base of the first metatarsal bone. (Macalister.)

Capsular Ligament of the Hip-joint - Cervical Reflection; Retinacula.

On opening the capsule of the hip-joint, some of the deeper longitudinal fibres are seen reflected upwards along the neck, so as to be attached higher up than would at first appear. These form the cervical reflection (Gray) or the retinacula (H. Morris). One of these reflected bands corresponds to the upper part, and another to the lower part, of the line of the capsular attachment; and a third band is seen at the upper and back part of the neck (H. Morris).

Ilio-Femoral, or Accessory Ligament of the Hip-joint, or Y-shaped Ligament of Bigelow.

This ligament often bifurcates inferiorly, forming two bands, of which one is attached to the lower part, and the other to the upper part, of the anterior intertrochanteric line (Gray's Anatomy, 12th Edition). This arrangement is regarded as the more usual one, hence the name of Y-shaped ligament which this structure has now pretty generally received.

The highest or outermost fibres of this ligament are coarse, almost straight, and shorter than the rest; the innermost fibres are also thick and strong, but oblique. This varying obliquity of the fibres, and their accumulation at the borders, explains why this band has been described as the Y-shaped ligament (H. Morris).

Ischio-Femoral Band.

This is formed of strong fibres attached all along the groove for the external obturator, and to the ischial margin of the acetabulum above the groove. (H. Morris.)

Pectineo-Femoral Band.

This is a distinct but narrow set of fibres which are fixed above to the anterior border of the pectineal eminence, reaching as far down as the lower end of the cotyloid notch. Below, these fibres reach the neck of the femur, and are fixed above and behind the lowermost fibres of the ilio-femoral band. (H. Morris.)

Between the ilio- and ischio-femoral bands there is incorporated with the capsule the reflected tendon of the rectus, and also a triangular band of fibres, the ilio-trochanteric band, which runs downwards to be attached by a narrow insertion to the ridge on the front border of the great trochanter near the gluteus minimus. (H. Morris.)

Fascia Iliaca.

The fascia which lines the posterior wall of the abdomen is, like the fascia transversalis, thin above and relatively thick below. It is divided above into Psoas and Iliac portions, which portions are united inferiorly.

Psoas Portion. – Attached *superiorly* to the ligamentum arcumentum internum; *externally and above*, to the anterior layer of the posterior abdominal aponeurosis, or fascia lumborum; *externally and below*, to the inner border of the iliac portion; *internally and above*, to the intervertebral discs and the prominent margins of the bodies of the vertebræ, – intervals being left opposite the constricted part of the bodies, which transmit the lumbar arteries and filaments of the sympathetic nerve; *internally and below*, to the brim of the pelvis.

Iliac Portion. – Attached *externally* and above to the whole of the inner lip of the crest of the ilium; *internally* to the outer border of the psoas portion.

Below the above points, the two portions of the fascia are united. This conjoined portion must be considered *externally* and *internally to*, and *opposite*, the femoral, or more correctly, external iliac vessels. [1] Externally to these vessels, the conjoined portion is attached to the fascia transversalis and to Poupart's ligament, the line of attachment forming a well marked linear thickening, the *white line of fusion* (Macalister). [2] *Internally to the vessels*, the conjoint portion is attached to the ilio-pectineal line, where it may be said to become continuous with the pubic portion of the fascia lata. [3] *Opposite the vessels*, the conjoined portion passes down into the thigh behind the femoral vessels to form the posterior wall of the femoral sheath, – this femoral prolongation (which is of course continuous with the *white line of fusion*) sending a process between the pectineus and the psoas, which becomes attached to the ilio-pectineal eminence and to the capsule of the hip-joint. (See also the Author's views on the surgical fasciæ, p. 108j.)

The nerves of the lumbar plexus lie behind the fascia iliaca, while the large vessels of the brim of the pelvis may be considered to lie in front of it, though in a sheath of their own as thick almost as the fascia itself. Psoas abscess, destroying fibres of the muscle, dissects out, so to speak, the nerves, which come to lie freely exposed in the cavity of the abscess; but the abscess leaves the vessels untouched.

The thigh being removed, the iliac fascia, if examined from below, will be seen to divide the space between the anterior border of the innominate bone and Poupart's ligament into two portions, the "*lacuna musculosa*" externally, and the "*lacuna vasculosa*" internally (Macalister): – the *former*, bounded by the white line of fusion, both above, and, internally, as it dips down on the inner side of the psoas to become attached to the ilio-pectineal eminence; the *latter* bounded above by Poupart's ligament & the fascia transversalis, behind by the iliac fascia and pubic portion of the fascia lata, internally by Gimbernat's ligament, and externally by the prolongation of the white line of fusion above referred to. – The lacuna vasculosa is occupied by the femoral vessels & their sheath and the crural branch of the genito-crural nerve, and the lacuna musculosa by the conjoined psoas and iliacus muscles with the anterior crural nerve and the external cutaneous branch of the lumbar plexus.

Anterior Annular Ligament of the Tarsus.

The anterior annular ligament of the tarsus consists of two portions, an upper and a lower. The *upper portion* is a strong band of transverse fibres extending from the lower part of the anterior border of tibia to the anterior border of the subcutaneous surface above the external malleolus; it binds down the vertical portion of the extensor tendons as they pass down to the foot. It is only the tendon of the tibialis anticus – the one nearest to its insertion – that has a synovial sheath under this part of the ligament. The *lower portion* of the ligament, considerably thinner, starts from the upper part of the greater process of the os calcis in two bands, superficial and deep. These bands pass inwards separately, forming a loop (the *fundiform ligament of Retzius*) enclosing the tendons of the extensor longus digitorum and peroneus tertius, both surrounded by, and enclosed in, a common synovial sheath. From the inner extremity of this loop some of the fibres are continued into upper and lower branches, which are, however, less regular in their arrangement: the stronger and more constant upper branch passes to the internal malleolus, crossing over the tendon of the extensor hallucis and then on the deep surface of the tendon of the tibialis anticus, only a few fibres passing superficially to the latter; the lower weaker branch, after crossing both these tendons, is inserted into the plantar fascia on the inner side of the foot. The tibialis anticus and the extensor proprius hallucis have each their synovial sheath.* (Quain, Morris.)

Internal Annular Ligament of the Tarsus.

The internal annular ligament of the tarsus crosses the space between the internal malleolus and the heel, through which run the tendons of the flexor muscles. Its upper border is continuous with the deep fascia of the leg (more especially with the deep or intermuscular layer of fascia), and is somewhat imperfectly defined. Its lower border gives origin to some of the fibres of the abductor hallucis, and is scarcely more distinct. Its anterior extremity is attached to the internal malleolus; its posterior extremity to the back part of the os calcis. Between these points the ligament arches over three osseous grooves, and gives rise to three canals. The first canal (nearest to the malleolus) contains the tendon of the tibialis posticus; the second, the tendon of the flexor longus digitorum; the third, the tendon of the flexor longus hallucis, – each tendon having its own synovial sheath. Between the two last-named tendons is a considerable interval for the posterior tibial vessels and nerve.

External Annular Ligament of the Tarsus.

This extends from the apex of the external malleolus to the outer side of the os calcis. It keeps in place, behind the external malleolus, the tendons of the peronei longus and brevis, placed close together, the latter being anterior. These tendons are surrounded by a common synovial sheath.

Morphology of the Arteries of the Limbs.

The arteries of the upper limb reach this limb in one set; those of the lower limb reach the latter in two sets. This is accounted for by the greater ventral fixity of the lower limb, which sunders the vessels and nerves of the root of this limb into anterior and posterior series, and somewhat obscures the relations of the correrponding vessels and nerves to each other.

* Most of this complicated description is suppressed by Cunningham, and very sensibly, the Author thinks.

The brachial artery corresponds, not to the femoral, but to the profunda femoris. Corresponding to the superficial femoral and popliteal, in the lower limb, we have, in the upper limb, the vas aberrans. This is normally but a small branch of the brachial, which passes in front of the median nerve, and inferiorly joins with the radial or sometimes with the ulnar. This branch may be greatly enlarged so as to take the place of the brachial artery, which then passes *in front* of the median nerve. In the forearm and leg, the ulnar and posterior tibial arteries are homologous; while to the anterior tibial and peroneal there correspond respectively, in the upper limb, the posterior and anterior interosseous. The external plantar artery corresponds to the deep branch of the ulnar and the deep palmar arch, – its continuation with the anterior tibial, the dorsalis pedis, corresponding to the radial on the dorsum on the hand. The radial artery is not otherwise represented in the lower limb. The superficial palmar arch is, as a rule unrepresented in the lower limb, though there exists sometimes a small branch of communication between the two plantar arteries. At the root of the limbs, the subscapular artery corresponds with the gluteal, and the posterior circumflex with the sciatic.

Morphology of the Nerves of the Limbs.

The nerves of the limbs are the greatly hypotrophied muscular and latera cutaneous branches of the ventral stem of the metameric nerve trunks.

The typical distribution of the spinal nerves obtains in the thoraco-abdomina region. It may be described as follows: –

Each metamere receives a pair of nerves, of which the main trunk divides into dorsal and ventral stems. The latter runs in the somatopleure to mid-ventral line, and gives off in succession (1) a muscular branch to the dorsal end of the somatopleure musculature, (2) a cutaneous branch to the skin over the postero-lateral aspect of the trunk, (3) a muscular branch to the ventral end of the somatopleure musculature, and (4) a cutaneous branch to the skin on the antero-lateral aspect of the trunk.

The above typical arrangement is preserved to some extent in the limbs. Here the two first of the branches of the ventral stem, or the lateral muscular and cutaneous branches, become the large trunks which form the root-plexuses. This is shown by an examination of the distribution of the first dorsal nerve, interpreted in the light of the evident homology of the scaleni and intercostal muscles. The first dorsal nerve divides into a small inferior branch, which is the representative of an ordinary intercostal nerve, and a large superior branch, – a representative of the lateral muscular and cutaneous branches above referred to, – which contributes to form the brachial plexus. The cervical roots of the brachial plexus are similarly to be looked upon as the combined lateral cutaneous and muscular branches above referred to, enormously hypertrophied, – the stem of the intercostal nerves being represented by the small muscular branches supplied to the scaleni.

The dorsal stem of the metameric nerves passes backwards to supply the muscle-plates and the skin covering them, and divides into external and internal branches, which separate the three divisions of the erector spinæ.

The evolution of the nerves of the limbs corresponds to that of the limb metameres: – The metameres are constricted and fused together at the root of each limb; the nerves blend to form the root-plexuses. The metameres segment into flexor and extensor masses: the primary nerve-trunks break up beyond the root-plexuses into primary flexor and extensor divisions. As the primary muscle masses segment into

individual muscles, nerves to supply the same are split of from the parent trunk. As secondary displacements and fusions occur here and there between the muscle elements, – a muscular element passing from the flexor to the extensor side of the limb, or *vice versa*, and carrying its nerve supply with it, – so do certain muscles obtain a double nerve supply: *e.g.*, brachialis anticus in the upper limb, adductor magnus in the lower limb.

The splitting of the three primary cords of the brachial plexus into anterior and posterior divisions represents the primary division of the plexus into flexor and extensor nerves: – From the junction of the three posterior divisions there results the posterior cord, which gives off the three subscapular, musculo-spiral, and circumflex nerves, all of which supply extensor muscles and the skin covering them. From the junction of the anterior divisions there proceed the inner and outer cords, from which are derived the anterior thoracic, musculo-cutaneous, median, ulnar, and internal cutaneous nerves, which supply flexor muscles and the corresponding skin.

Like the arteries, the nerves of the upper arm enter the limb in one set: those of the lower limb in two sets, – these not representing, however, a definite division into flexor and extensor nerves. While on the front of the thigh we have a pure extensor nerve, the anterior crural, we find at the back the flexor and extensor elements fused, yet easily separable from each other, in a mixed nerve, the great sciatic

The homologies of the nerves of the limbs are as follows: –

EXTENSOR NERVES: –

Upper Extremity:	*Lower Extremity:*
Subscapular.	Inferior gluteal.
Circumflex.	Superior gluteal.
Suprascapular and musculo-spiral.	Anterior crural.
Brs. of musc.-spiral in forearm, *i.e.*, post. interosseous and radial.	Peroneal division of great sciatic, with anterior tibial and musculo-cutaneous.

FLEXOR NERVES: –

Upper Extremity:	*Lower Extremity:*
Ext. and int. ant. thoracic, br. from musc.-cutaneous to coraco-brachialis.	Obturator.
Brs. of musc.-cutaneous to biceps and brachialis anticus.	Brs. of popliteal division of great sciatic to hamstrings.
Median and ulnar in forearm.	Popliteal division of great sciatic and posterior tibial
Median in hand.	Internal plantar in foot.
Ulnar in hand.	External plantar in foot.

Pseudo-Ganglia.

The so-called gangliform enlargements on the branch of the circumflex nerve to the teres minor, on the branch of the musculo-spiral nerve to the anconeus, on the branch of the anterior tibial nerve to the extensor brevis digitorum, on the posterior interosseous nerve at the back of the wrist, are pseudo-ganglia, which do not contain any nerve cells They indicate that some structure, which the nerve originally supplied, has degenerated: the nerve which supplied such structure having become suppressed, the trunk from which the suppressed nerve was derived has become shortened and thickened.

Thus the pseudo-ganglion on the posterior interosseous nerve probably represents the suppressed nerve to a muscle which once existed in the hand, and which corresponded to the extensor brevis digitorum of the foot. Similarly there is reason to believe that the pseudo-ganglion on the nerve to the teres minor represents the suppressed nerve which originally supplied the piece of muscle between the deltoid and teres minor, which muscle has dengerated into the thick fascia covering the infraspinatus.

See also notes on—

The Adductor Magnus, p. 108d.

The Peroneus Longus, p. 108d.

The Extensor Brevis Digitorum, and Peroneus Tertius, p 108d.

The Abductor Ossis Metatarsi Quinti, p. 108c.

The Plantar Fascia, p. 108b.

The Interosseous Membrane of the Leg, p. 108c.

The Calcaneo-cuboid Ligaments, p. 108b.

The Greater and Lesser Sacro-Sciatic Ligaments, p. 108f.

The Round Ligament of the Hip-Joint, p. 108d.

The Ligaments of the Knee-Joint, p. 108d.

The Synovial Membrane of the Knee-Joint, p. 108c.

The Lumbo-Sacral & Lumbo-Iliac Ligaments, p. 108b.

The Deep Fascia of the Limbs, p. 108a.

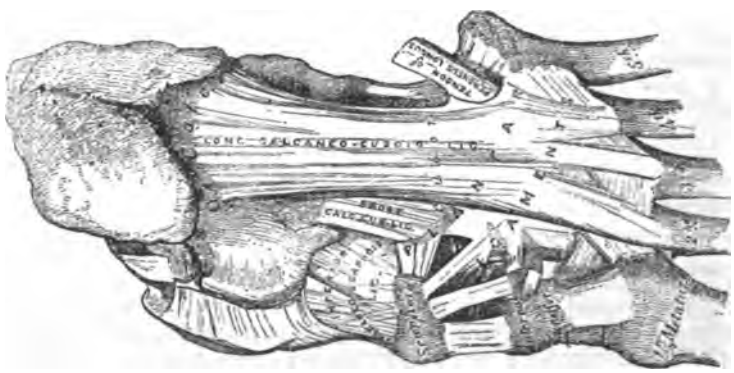


FIG. 270c.—LIGAMENTS OF SOLE OF THE FOOT. (Gray.)

EXPLANATION OF FIGURES NOT FULLY EXPLAINED IN THE TEXT.

(Lower Limb.)

FIG. 223.—CUTANEOUS NERVES OF FRONT & INNER SIDE OF THIGH. (Hirschfeld.)

(1, 1) **Middle cutaneous nerve**, first at its origin, and then piercing the sartorius and deep fascia; it joins with, 2, the external cutaneous branch of the lumbar plexus; (3, 3) **external branch of internal cutaneous nerve**, piercing the fascia at lower third of thigh, and giving off a small branch, 4, to the sartorius; (5) **its internal branch**, piercing the fascia a little above the knee, at 6, and giving off a deep branch, 7, which is seen in the next plate to join with the anterior branch of the obturator nerve; 8, cutaneous offset from nerve to pectineus; 9, patellar branch of internal saphenous nerve; 10, its continuation along inner side of leg. A, internal saphenous vein; B, femoral vein, receiving in this case the superficial epigastric vein, which usually opens into the internal saphenous; D, femoral artery.

FIG. 224.—DEEP NERVES OF FRONT & INNER SIDE OF THIGH. (Hirschfeld.)

(1) **Anterior crural nerve**, arising from 3rd, 4th, & 5th lumbar nerves; 2 & 3, its branches to psoas & iliacus; 4, middle cutaneous, and greater part of internal cutaneous nerves, divided; 8, internal branch of the latter, joining with obturator nerve; 5, nerve to the pectineus, with, 7, the cutaneous filament it gives off; 9, 10, 11, nerves to rectus, vastus externus, & vastus internus; (12) **internal saphenous nerve** in, and leaving, Hunter's canal; 13, its patellar branch; 14, its continuation to the inner side of the leg; (15) **obturator nerve**, arising from 3rd, 4th, & 5th lumbar nerves: at the upper and inner part of the thigh it is seen piercing the obturator externus, and dividing into its anterior & posterior divisions, the latter, 19, deeply shaded, and seen behind the divided adductor brevis; the anterior division gives off branches to adductor longus, adductor brevis, and to the gracilis; (20) **lumbo-sacral cord**, formed by anterior divisions of 5th lumbar & 1st sacral nerves; 21, sacral plexus; 22, sacral ganglia of the sympathetic; (23) **external cutaneous nerve** of lumbar plexus.

FIG. 232.—DISTRIBUTION OF EXTERNAL POPLITEAL NERVE: SUPERFICIAL DISSECTION. (Hirschfeld.)

(1) **External popliteal nerve**, winding round neck of fibula in substance of peroneus longus; 2, its cutaneous branches, of which one, **the communicas fibularis**, (3) is seen to join with (4) **the communicans tibialis** from the internal popliteal nerve, thus forming **the external saphenous** nerve (5); (9) **musculo-cutaneous nerve**, first issuing from between the peronei muscles and the extensor longus digitorum, and then piercing the deep fascia, and dividing into its two terminal branches, 10, 10; (13) **anterior tibial nerve**, getting between the tibialis anticus and the extensor longus digitorum; 14, its internal terminal branch, which accompanies the dorsalis pedis artery, and, joining with the musculo-cutaneous, supplies the adjoining sides of the great & second toes

FIG. 233.—DISTRIBUTION OF THE EXTERNAL POPLITEAL NERVE: DEEP DISSECTION. (Hirschfeld.)

(1) **External popliteal nerve**; 2, its recurrent branch to the knee-joint; (3) **musculo-cutaneous nerve**, giving branches to the peronei longus & brevis, 4 & 5; 6, its two terminal branches, somewhat separated by the dissection; 7, its internal branch; 8, its external branch, joining with the external saphenous nerve, 9; (10) **anterior tibial nerve**, giving branches to extensor longus digitorum, extensor proprius pollicis, tibialis anticus pollicis; passing at 14 beneath the tendon of extensor proprius pollicis, 13, its division into its two terminal branches. The internal branch, 16, is seen joining with the musculo-cutaneous nerve, and supplying the sides of the big and second toes; the external branch, 17, is seen to pass out beneath the partly removed extensor brevis digitorum, which it supplies; it presents a small pseudo-ganglion.

FIGS. 239 & 354.—SACRAL PLEXUS. (Hirschfeld.)

(7) **Lumbo-sacral cord**; 1, 2, 3, 4, 5, the five sacral nerves; 6, the coccygeal nerve; 8, 8, sacral ganglia of the sympathetic, with their communications with the foregoing and with each other; 9, sacral plexus; 10, its visceral branches, divided; 11 & 12, its muscular branches to the levator ani and the obturator internus; 13, inferior hæmorrhoidal nerve; (14) **pudic nerve**, dividing into the **dorsal nerve of the penis** (15) and the perineal nerve, 16; 17, 18, 19, the three branches of the latter, posterior or internal, anterior or external, & muscular; (20) **superior gluteal nerve**, leaving the pelvis through the upper part of the great sacro-sciatic notch; (22) **small sciatic nerve**, with its inferior pudendal branch, 21; (23 **obturator nerve**. *e*, levator ani, divided.

FIG. 240.– POSTERIOR NERVES OF THE THIGH & HIP: SUPERFICIAL DISSECTION. (Hirschfeld.)

(1) Small sciatic nerve, exposed by the removal of a portion of the gluteus maximus; 2, its inferior gluteal branch; 3, its ascending cutaneous branches, supplying integument over gluteus maximus; 4, its inferior pudendal branch; 5, trunk of the nerve as it descends beneath the fascia at the back of the thigh, giving off cutaneous branches external and internal; 10, posterior division of the external cutaneous nerve.

FIG. 241.—POSTERIOR NERVES OF THE THIGH & HIP: DEEP DISSECTION. (Hirschfeld.)

(1) Superior gluteal nerve, with the accompanying gluteal artery, dividing into superior & inferior branches, both exposed by the partial removal of the gluteus medius; (2) small sciatic nerve at its origin; 3, its muscular branches to the gluteus maximus (inferior gluteal); 4, 6, trunk of the nerve lower down the thigh; 5, its inferior pudendal branch; 8, pudic nerve, and, 9, nerve to the obturator internus, winding round spine of ischium beneath the great sacro-sciatic ligament; (10, 10) great sciatic nerve, giving off muscular branches to long head of biceps, short head of biceps, semitendinosus, semimembranosus, adductor magnus; (17) internal popliteal nerve, giving off muscular branches to the gemelli and to the soleus, 17 and 18; (19) communicans tibialis, or inner root of external saphenous nerve; (20) external popliteal nerve; (21) communicans fibularis, or outer root of the external or short saphenous.

FIG. 242.—POPLITEAL VESSELS AND NERVES. (Hirschfeld.)

The semi-tendinosus and -membranosus, the long head of the biceps, and the central part of the gastrocnemius have been removed. (1) Great sciatic nerve; (2) external popliteal nerve, giving off the communicans fibularis (3), which joins with the communicans tibialis, 6; (5) internal popliteal nerve, giving off the communicans tibialis, 6, 6, and muscular branches to the heads of the gastrocnemius, 7, 7, the plantaris, 8, the popliteus, 9, the soleus, 10. A, popliteal vein, receiving the short saphenous, B, B; C, popliteal artery.

a, short head of the biceps; *b*, long head, divided; *d*, divided tendon of semi-membranosus; *e*, tendon of adductor magnus, with, *f*, the opening for the popliteus vessels; *h*, plantaris hooked out of the way.

FIG. 248.—DEEP NERVES OF BACK OF LEG. (Hirschfeld.)

(1) External popliteal nerve, winding round the neck of the fibula in the substance of the peroneus longus; (2) internal popliteal nerve, passing beneath the arch of the soleus, and becoming posterior tibial nerve (3); which latter gives off branches to tibialis posticus, 5, flexor proprius pollicis, 6, flexor longus digitorum, 7; 4, its inferior internal articular branch; 8, its plantar cutaneous branch; 9, its division into internal and external plantar. *f*, tendon of tibialis posticus behind internal malleolus; D, posterior tibial artery dividing at E into internal and external plantar.

FIGS. 256, 257, & 258.—THE NERVES OF THE SOLE OF THE FOOT. (Hirschfeld.)

Figs. 256 and 257 show the plantar fascia and the muscles of the two first layers, - the muscles of the first layer being partly cut away in Fig. 257.

It will be best to examine Fig. 257 in the light of Fig. 258, and Fig. 256 in the light of both of the ollowing figures.

In Fig. 257: 1, internal plantar nerve, presenting an inner division, 3, which supplies the abductor and flexor brevis pollicis, and becomes the internal plantar digital nerve to the big toe; and an outer division, 6, supplying the two inner lumbricales, and the plantar digital nerves to the remainder of 3½ toes on the inner side of the foot; 8, external plantar nerve, supplying the flexor accessories and the abductor minimi digiti, and dividing a superficial branch, 12, and a deep branch, 11; the superficial branch supplying the flexor brevis minimi digiti, and the interossei of the fourth space, and giving off the remaining plantar digital nerves; and the deep branch, which is better shown in Fig. 258, supplying the adductor pollicis and transversus pedis and the remaining interossei; 7, junction of the internal and external plantar nerves.

In Fig. 256: 3, 4, 5, 6, 10, 11, the several plantar digital nerves; 7, the external plantar nerve, just showing its division into superficial and deep branches; 1, the plantar cutaneous nerve.

SUMMARY OF PRACTICAL POINTS.

LOWER LIMB.

Poupart's Ligament.—From anterior superior spine of ilium to spine of pubes. Convex downwards and outwards. *External abdominal ring and inguinal hernia* lie above and internal, and *femoral ring and hernia* below and external, to it.

Fold of the Groin.—Due to adhesion of deep layer of superficial fascia to Poupart's ligament. Urine extravasated through rupture of membranous portion of urethra infiltrates first the scrotum, and then the superficial fascia of the abdomen—not that of the thigh, on account of this adhesion.

Lymphatic Glands (two sets).—**Inguinal**: Lie just below and parallel to inner half of Poupart's ligament; receive lymphatics of penis, scrotum, perinæum, lower part of abdomen, and buttock. **Femoral**: Situated lower down, on outer side of internal saphenous vein; receive lymphatics of lower limb, and some of those of scrotum.

Saphenous Opening.—Situated *an inch and a half* below and external to spine of pubes, below junction of inner and middle thirds of Poupart's ligament. Is covered in by the cribriform fascia. Its *outer boundary* is prominent and well defined, and formed by the iliac portion of the fascia lata; its *inner boundary* is depressed and less clearly defined, and formed by the pubic portion.

Femoral Ring.—May be defined by feeling for the pulsation of the femoral artery on the pubes, and allowing half an inch on the inner side of the artery for the femoral vein; the ring is just internal to the vein. It lies about half an inch higher than the saphenous opening, immediately under the inner part of Poupart's ligament.

It is bounded internally by the sharp, cutting edge of Gimbernat's ligament; behind by the pubes, covered by the pectineus muscle; externally by the femoral vein; and above by Poupart's ligament, with the deep crural arch, and in the male the spermatic cord. On its inner side there may be an abnormal obturator artery; this occurs when the obturator artery presents the double abnormality of arising from the epigastric, and of arising from the epigastric at some distance from the origin of the latter from the external iliac. In this case the trunk common to the two arteries passes inwards above the femoral ring, and then the obturator artery descends into the pelvis on the inner side of the ring, behind Gimbernat's ligament.

Anterior Superior Spine of Ilium.—The most convenient point from which to measure the relative length of the two lower limbs in suspected fracture, dislocation, or hip-joint disease.

Great Trochanter.—Lies in a line drawn from anterior superior spine of ilium to most prominent part of tuberosity of ischium (*Nelaton's line*). It is more convenient, however, as a test of dislocation or fracture, to compare on the two sides the vertical distance between the great trochanter and the anterior superior spine of the ilium (*Bryant's test*). The upper part of the great trochanter is nearly on a level with the spine of the pubes.

Sartorius Muscle.—Easily defined on the living by instructing peatint to raise his leg over thigh of opposite side. Forms outer border of Scarpa's triangle, at apex of which it *crosses femoral artery three or four inches below Poupart's ligament.* Further down, over Hunter's canal, the muscle becomes somewhat internal to the artery.

Femoral Artery.—Along *upper two-thirds of a line* drawn from *midway between anterior superior spine of ilium and symphysis pubis to inner side of inner condyle of femur.* Gives off the profunda from *one and a half to two inches* below Poupart's ligament. Is crossed by the sartorius at apex of Scarpa's triangle, *three or four inches* below same ligament. In middle of thigh, it lies in Hunter's canal, beneath outer border of sartorius. Can

best be compressed directly backwards on pubes. Can also be compressed outwards against femur at apex of Scarpa's triangle.

Femoral Vein.—Lies close to inner side of artery at brim of pelvis, but soon gets behind it; lies behind it and to its outer side in Hunter's canal.

Anterior Crural Nerve.—Enters thigh half an inch on outer side of femoral artery. The *long saphenous nerve* accompanies the artery in Hunter's canal, lying in front of it and to its outer side.

Gluteal Artery.—Emerges from upper part of great sacro-sciatic foramen at junction of middle and upper thirds of a line drawn from posterior superior spine of ilium to great trochanter when limb is rotated slightly inwards.

Pudic and Sciatic Arteries.—Emerge from lower part of same foramen at junction of middle and lower thirds of a line drawn from posterior superior spine of ilium to outer part of tuberosity of ischium.

Fold of Buttock.—Crosses the middle of the lower border of the gluteus maximus; is lowered in downward dislocations of the hip, and partly effaced in hip-joint disease.

Great Sciatic Nerve.—Can easily be exposed by an incision downwards from above fold midway between great trochanter and tuberosity of ischium; it lies on the outer side of, and then just beneath, the biceps.

Patella.—Its *inner border*, which is more prominent than the outer, lies in a line with the big toe. The *apex* of the patella, the *ligamentum patellæ*, the *tubercle of the tibia*, and the *middle of the ankle-joint* are also in a line one with another.

In extension, the patella lies almost entirely above the femoral condyles. In flexion, it corresponds to the intercondyloid notch, and rests mainly on the outer condyle.

Bursa Patellæ.—Lies partly over lower part of the patella, and partly over the *upper part of the patellar ligament.* Care must be taken, in excising the hypertrophied bursa, not to open the capsule of the knee-joint. There is a bursa beneath the ligamentum patellæ.

tibial nerve on its outer side. It can be felt half an inch behind and external to the internal malleolus.

On Inner Side of Foot.—Is the prominent projection of the *tubercle of the scaphoid*, which, as regards the skin incisions, is the guide to Chopart's, or the medio-tarsal, amputation. It lies *an inch* in front of the internal malleolus, and between and a little behind the two bony processes is the lesser process of the os calcis, or sustentaculum tali. An *inch and a half* in front of the tubercle of the scaphoid is the line of Lisfranc's, or the tarso-metatarsal, amputation.

On Outer Side of Foot.—Is the prominent projection of the *base of the fifth metatarsal bone*, which lies about two inches in front of the external malleolus, and is the best guide to Lisfranc's amputation. Midway between it and the external malleolus is the line of the medio-tarsal, or Chopart's, amputation, the precise position of which is indicated by the projection of the os calcis, termed the *tubercle of Chopart.**

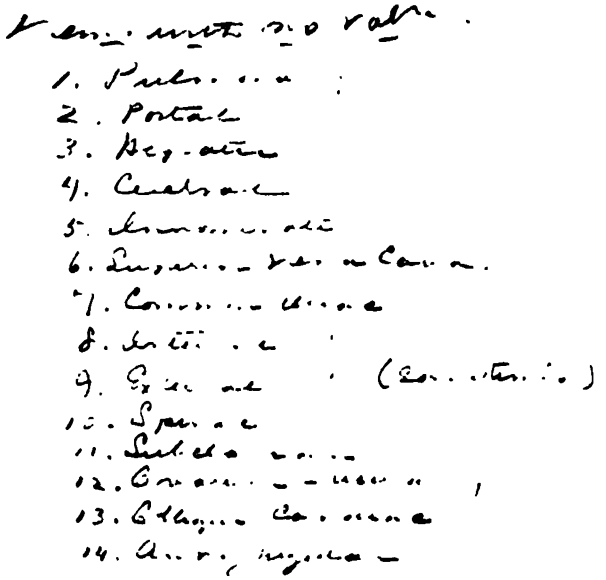
Dorsalis Pedis Artery.—Extends from midway between the malleoli to back part of first interosseous space, lying on bones of tarsus between tendon of extensor proprius hallucis and innermost tendon of extensor brevis digitorum, which latter crosses it near its termination. It has the anterior tibial nerve on its outer side.

Internal Plantar Artery.—Runs between flexor brevis digitorum and abductor and flexor brevis pollicis, from inner side of os calcis towards middle of big toe.

External Plantar Artery.—Runs beneath flexor brevis digitorum from same point to base of fifth metatarsal bone, and then deeply across sole of foot to back of first interosseous space, where it joins with communicating branch of dorsalis pedis.

(*See practical questions at end of book.*)

* N.B.—In Lisfranc's amputation, one and the same guide, the base of the fifth metatarsal bone, serves both for the skin incisions and for the disarticulation. In Chopart's amputation, there is one guide for the skin incisions, the tubercle of scaphoid, and another for the disarticulation, the tubercle of the os calcis or tubercle of Chopart. As these latter tubercles are opposite each other, it may be wondered why the description of the operation is complicated by two guides being given instead of one. The reason is that, while the tubercle of Chopart stands up in front of the cuboid in such a way that the knife placed against it is bound to enter the joint at once, and thus the tubercle is the best possible guide for opening the joint, it is, on the other hand, not nearly so prominent, before the skin is divided, as is the tubercle of the scaphoid, and is therefore not so good a guide for the skin incisions. The tubercle of the scaphoid, on the other hand, though a better guide for the skin incisions, is not so good a guide to the articulation, which is here a curved line more difficult to find than the straight line of the calcaneo-cuboid joint.



INGUINAL & FEMORAL HERNIÆ,

AND PERINÆUM.

SCARPA'S TRIANGLE—1st Tablet.

Is a broad triangular depression
Situated at upper, inner, & front part of thigh;
Bounded by Poupart's ligament, sartorius & adductor longus;
Continued downwards & inwards into a superficial furrow, which marks position of femoral artery in Hunter's canal.

Its floor is formed from without inwards by iliacus, psoas, pectineus, & small part of adductor brevis.
It contains femoral vessels & anterior crural nerve, and the

PARTS CONCERNED IN FEMORAL HERNIA — These parts are :-

SKIN — Thin, freely movable, more or less studded with hairs at upper & inner part.

SUPERFICIAL FASCIA — Divided into two layers by superficial vessels & nerves & inguinal lymphatic glands.

SUPERFICIAL LAYER - Thick, areolar, contains a large amount of fat, and is continuous with subcutaneous tissue of surrounding regions; is rather thinner & less loaded with fat towards lower part of triangle.

DEEP LAYER - Thin & membranous. Adherent superiorly to Poupart's ligament. Stretches over saphenous opening under the name of "*cribriform fascia*," which fascia is perforated by internal saphenous vein & by numerous smaller blood & lymphatic vessels, and is attached firmly to outer margin of the opening, & slightly to the inner margin.

Superficial Vessels & Nerves and Lymphatic Glands - Are the :
Internal saphenous vein ;
Superficial epigastric, superficial circumflex iliac, superficial external pudic arteries with the corresponding veins, which latter open into internal saphenous near its termination;
Ilio-inguinal, crural branch of genito-crural, & external cutaneous nerves.
Lymphatic glands - Form two groups. Those of the
Superior or abdominal group - Are the smaller, and are placed transversely near Poupart's ligament; - they receive lymphatics of penis, scrotum, perinæum, lower part of abdomen & buttock. - those of the
Inferior or femoral group - Are the larger, and are vertically disposed round upper part of saphenous vein ; - they receive the lymphatics of lower limb.

DEEP FASCIA or FASCIA LATA — Dense, fibrous. Presents the saphenous opening, for easier description of which it is usually divided into two portions, the iliac & the pubic.

ILIAC PORTION - The thicker. Attached to crest of ilium, Poupart's ligament & spine of pubes. Is reflected downwards & outwards from this latter point, first bounding the superior angle, or *superior cornu* of the opening, then forming its outer margin. This outer margin is the *falciform process of Burns* ; its upper part is often called *Hey's femoral ligament*. Superiorly this margin overlies the sheath of the femoral vessels. Inferiorly it becomes continuous with pubic portion of the fascia lata by a well defined curved border, which forms the inferior angle, or *inferior cornu* of the opening.

PUBIC PORTION - Much thinner. Is attached to pubic arch at upper and inner part of thigh, and is continuous with iliac portion opposite lower cornu of saphenous opening. From this point it is prolonged upwards & outwards behind femoral sheath & in front of pectineus, and becomes attached to ilio-pectineal line.

Saphenous Opening - Is formed therefore by the slitting of the fascia lata & by the folding of the two sides of the slit one over the other. It is oval in shape, broad below, narrow above, 1½ inches long, ½ an inch wide. Its

OUTER BOUNDARY & ITS SUPERIOR ANGLE OR CORNU, - Which are prominent & well defined. are formed by iliac portion of the fascia lata (falciform process & femoral ligament), which portion, as already stated, passes upwards & inwards in front of the femoral sheath, and becomes attached to Poupart's ligament & spine of pubes. - Its

INNER BOUNDARY - Depressed & less clearly defined, is formed by the pubic portion of the fascia lata, which portion, as already stated, passes upwards & outwards behind femoral sheath & in front of pectineus, and becomes attached to the ilio-pectineal line. - Its

INFERIOR ANGLE OR CORNU - Is formed by the junction of the iliac & pubic portions of the fascia lata just below opening of internal saphenous vein into the femoral.

FEMORAL SHEATH - Vide next Tablet.

Scarpa's triangle - 6 months.
Hunter's Canal — 6 "
Popliteal Space — 6 "

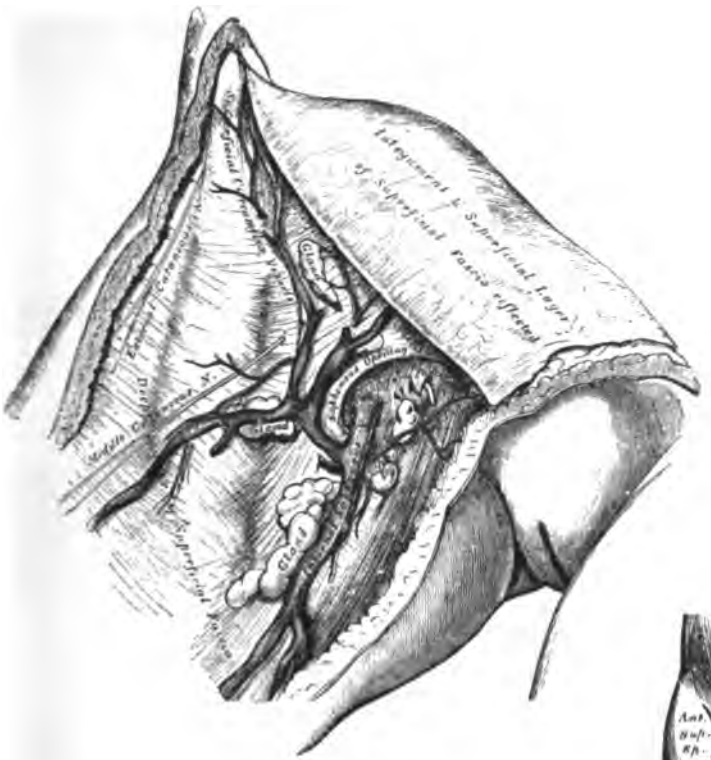


FIG. 271.—FEMORAL HERNIA, SUPERFICIAL DISSECTION. (Gray.)

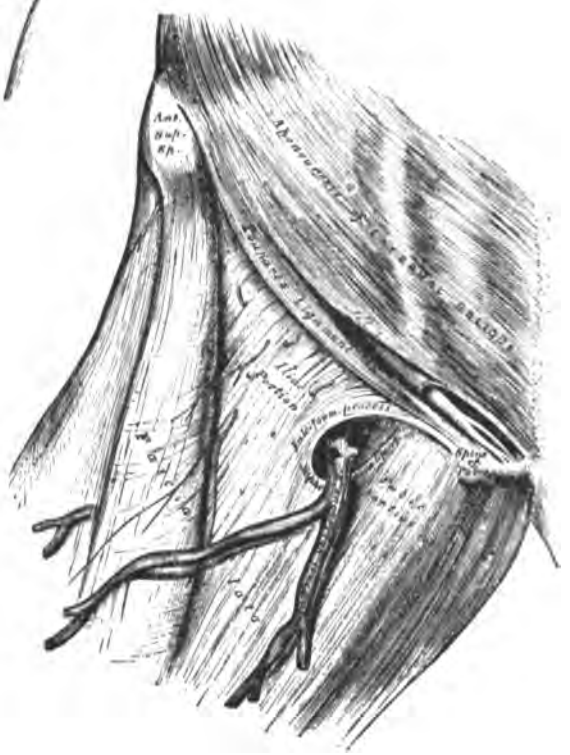


FIG. 272.—FEMORAL HERNIA, SHOWING FASCIA LATA AND SAPHENOUS OPENING. (Gray.)

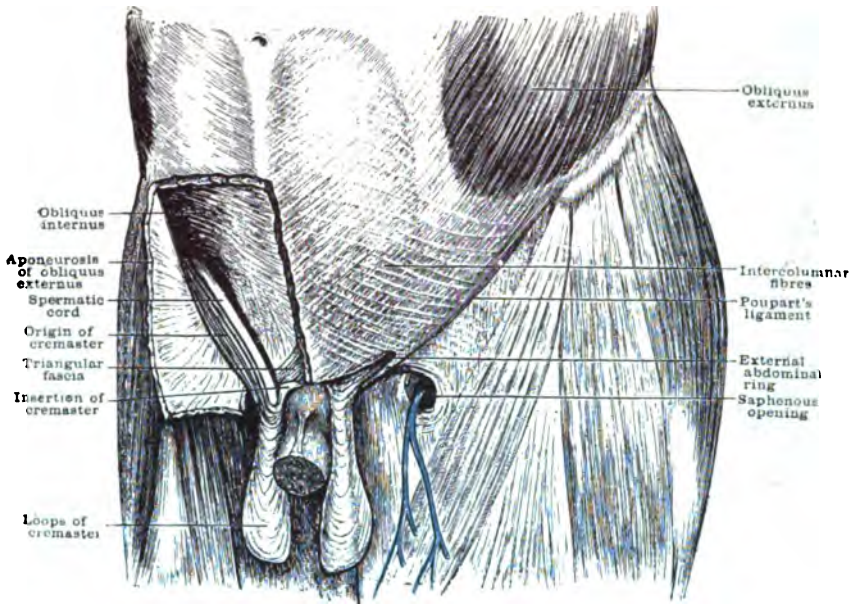
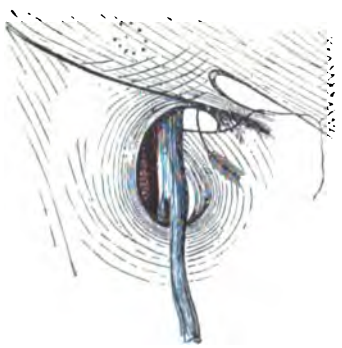
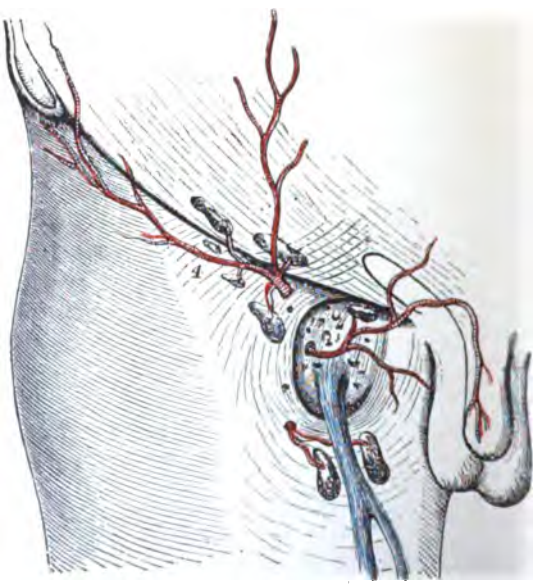


FIG. 273.—THE SAPHENOUS OPENING; THE EXTERNAL ABDOMINAL RING, WITH THE INTERCOLUMNAR FIBRES AND THE CREMASTER MUSCLE. (Morris.)





FIGS. 274 & 275.—THE SAPHENOUS AND THE EXTERNAL ABDOMINAL & FEMORAL RINGS. (Holden.)

The arrow in Fig. 274 passes through the saphenous opening and the femoral ring.

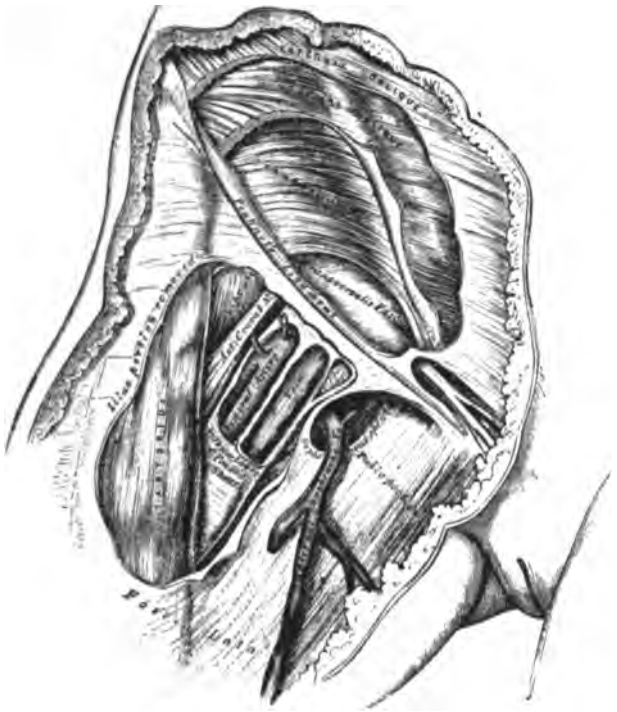


FIG. 276.—FEMORAL HERNIA: ILIAC PORTION OF FASCIA LATA REMOVED, AND SHEATH OF FEMORAL VESSELS AND FEMORAL CANAL EXPOSED. (Gray.)

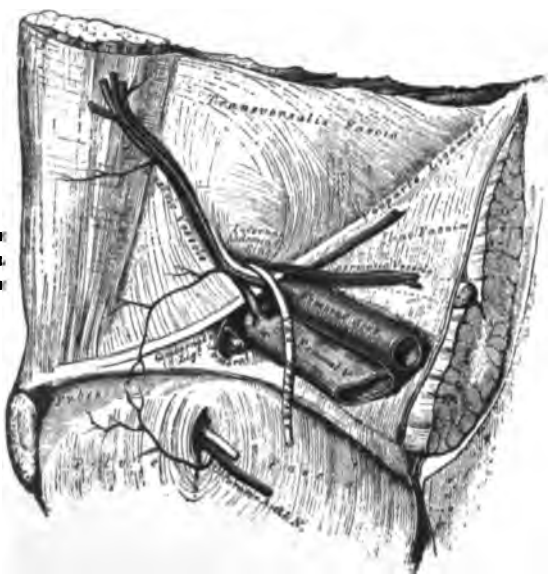


FIG. 277.—THE RELATIONS OF THE FEMORAL AND INTERNAL ABDOMINAL RINGS, AS SEEN FROM WITHIN THE ABDOMEN; RIGHT SIDE. (Gray.)

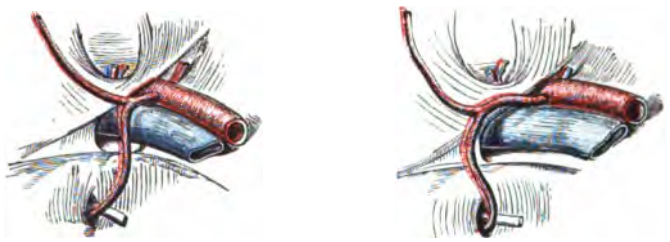


FIG. 278.—VARIATIONS IN THE ORIGIN AND COURSE OF OBTURATOR ARTERY. (Gray.)

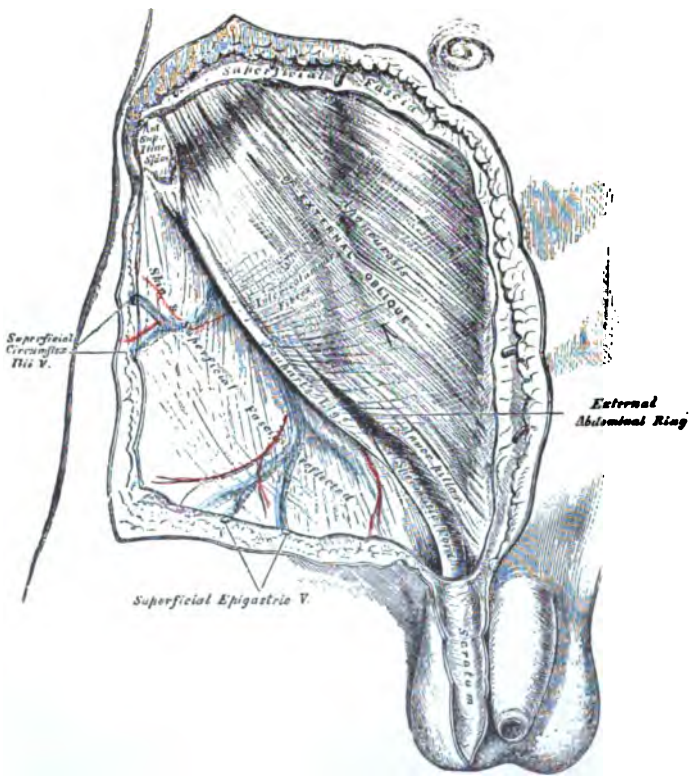


FIG. 279.—INGUINAL HERNIA: SUPERFICIAL DISSECTION. (Gray.)

SCARPA'S TRIANGLE—2nd Tablet.

FEMORAL SHEATH – Is a thin tube of fascia divided by two delicate septa into three compartments, of which compartments the outermost contains the femoral artery & the crural branch of the genito-crural nerve, the middle one the femoral vein, and the innermost, which is called the femoral canal, some fat & a lymphatic gland.

It is expanded superiorly, where it is continuous beneath Poupart's ligament with the fascia of the abdomen, the fascia transversalis & the fascia iliaca passing down to form it, the former in front of, and the latter behind, the femoral vessels.

It is narrow inferiorly, and blends about two inches below Poupart's ligament with the common areolar sheath of the femoral vessels.

Anteriorly it is covered by the iliac portion of the fascia lata (falciform process & femoral ligament), Poupart's ligament, the deep crural arch, and, opposite the saphenous opening, by the cribriform fascia.

Posteriorly it rests upon the pubic portion of the fascia lata & the pectineus muscle.

Its outer wall is vertical, lies in immediate contact with the artery, and is perforated by the crural branch of the genito-crural nerve.

Its inner wall is oblique downwards & outwards from base of Gimbernat's ligament to inner surface of femoral vein. It is pierced superiorly, where it corresponds to the femoral canal, by numerous lymphatic vessels, and, inferiorly, or below the femoral canal, by the internal saphenous vein.

FEMORAL CANAL – Is the innermost compartment of the femoral sheath. Or rather it is the narrow interval comprised, at the upper part of the femoral sheath, between the inner wall of the sheath & the femoral vein; for it can hardly be said to exist as a distinct canal unless the wall of the sheath has been separated from the vein either by dissection or by the pressure of a hernia. - It contains a little fat & a lymphatic gland.

It extends from the femoral ring to the upper part of saphenous opening, and measures from ½ to ¾ an inch in length.

It presents four walls & two openings.

ANTERIOR WALL - Formed by the fascia transversalis, and supported by Poupart's ligament, deep crural arch, & iliac portion of fascia lata (falciform process & femoral ligament);

POSTERIOR WALL - Formed by the fascia iliaca· rests upon pubic portion of fascia lata & pectineus muscle;

INNER WALL - Formed by junction of fascia transversalis & iliaca;

OUTER WALL - Formed by the thin septum on inner side of femoral vein;

SUPERIOR OPENING, OR FEMORAL RING - Vide below.

INFERIOR, OR SAPHENOUS OPENING - Vide foregoing Tablet.

Femoral Ring - Is the opening of the femoral canal into the abdomen. - Its boundaries are:-

IN FRONT - Poupart's ligament and the deep crural arch;

BEHIND - Pubes covered by pectineus muscle, & pubic portion of fascia lata;

INTERNALLY - Gimbernat's ligament with the triangular ligament, the conjoined tendon, & the deep crural arch.

EXTERNALLY - Femoral vein & the thin septum between it & crural canal.

Its relations are as follows:

Femoral vein, on outer side;

Epigastric artery, crossing upper & outer angle;

Spermatic cord or round ligament, & pubic branch of epigastric above & in front;

Obturator artery, on inner side, in those rare cases in which the artery presents the double abnormality of arising from the epigastric artery, and of arising from that artery at some distance from its root, - the obturator artery then passes first inwards above the ring, and then downwards into the pelvis behind Gimbernat's ligament.

It is nearly circular, about ½ an inch wide in the male, a little wider in the female, and is closed by the

SEPTUM CRURALE (J. Cloquet) - A more or less condensed layer of superitoneal areolar tissue adherent to margins of femoral ring, and perforated by numerous apertures for lymphatics. Its upper surface is concave, and separated from the peritoneum by a less condensed layer of the same tissue and sometimes by a lymphatic gland; its under surface is convex & turned towards the femoral canal.

The femoral canal & both its openings are constricted by extension & eversion, and relaxed by flexion & inversion of the thigh.

COVERINGS OF FEMORAL HERNIA – Are:-

FROM WITHIN OUTWARDS : - *Peritoneum, subperitoneal areolar tissue* (a portion of which, thickened & caused to assume a membranous appearance by the pressure of the hernia, was described by Sir A. Cooper under the name of *fascia propria*), *septum crurale, crural sheath, cribriform fascia, superficial fascia, skin.*

FROM WITHOUT INWARDS : - *Skin, superficial fascia, cribriform fascia, crural sheath, septum crurale, subperitoneal areolar tissue, peritoneum.*

The deep seated stricture is to be divided upwards & inwards, in which direction no important vessel is likely to be met with.

PARTS CONCERNED in INGUINAL HERNIA—1st T.

form the inguinal & scrotal regions. From the latter are derived the superficial coverings of large hernias, which superficial coverings are the same as those of the cord & testis. The former comprises the parts more directly concerned in the occurrence of the protrusion, and in the surgical operations thereby required.

SCROTAL REGION — Vide "Coverings of Cord & Testis."

INGUINAL REGION — Bounded by Poupart's ligament, median line, horizontal line through anterior superior spine of ilium. Presents for examination the following strata, between which the inguinal canal is comprised.

Skin – Thin, freely movable, depressed over Poupart's ligament.

Superficial Fascia – Continuous with that of thigh, scrotum (dartos) & perinæum. Divided into superficial & deep layers by the superficial vessels & nerves.

SUPERFICIAL LAYER – Thick, areolar, & more or less distended with fat. Passes over Poupart's ligament without adhering to it.

DEEP LAYER – Thin, membranous, contains no fat; adheres to Poupart's ligament.

SUPERFICIAL VESSELS & NERVES — Are:

Arteries – Superficial epigastric, superficial circumflex iliac, superficial external pudic.
Veins – Corresponding: open into internal saphenous.
Lymphatics – Converge towards the
Superior or Abdominal set of Inguinal Lymphatic Glands – Three or four, small, obliquely disposed along Poupart's ligament; receive lymphatics of penis, scrotum, perinæum, lower part of abdomen & buttock.
Nerves – Ilio-inguinal, & hypogastric branch of ilio-hypogastric.

Aponeurosis of External Oblique – Its fibres are oblique downwards & inwards, and form in succession *Poupart's ligament, Gimbernat's ligament, Outer or Inferior pillar of external abdominal ring, Inner or Superior pillar, Superficial part of Linea Alba* by decussating with their fellows, and perhaps also, after decussating, the *Triangular ligament & the Intercolumnar fibres of opposite side* (Vide Abdominal Aponeuroses). Continuous with this stratum of fibres is the *Intercolumnar or external spermatic fascia*, thin, closely adherent to margin of external abdominal ring, and prolonged downwards into a tubular process around cord and testis.

Lower Part of Internal Oblique – Thin & pale. Its fibres, which arise from outer half of Poupart's ligament, pass *inwards over spermatic cord (or round ligament)*, and then curve *downwards behind it* & behind external abdominal ring & Gimbernat's ligament, covering inner two-thirds of Hesselbach's triangle and forming part of conjoined tendon of internal oblique & transversalis, and, becoming tendinous, are inserted over the extent of about half an inch into crest of pubes in front of rectus and into ilio-pectineal line behind Gimbernat's ligament.

THE CREMASTER MUSCLE – (Vide "Muscles of the Abdomen" & "Coverings of the Testicle") is connected with lowest fibres of internal oblique, and occasionally also with some of the lowest fibres of transversalis.

Lower Part of Transversalis – Also thin & pale. Its fibres, which arise from outer third of Poupart's ligament, take the same course as preceding, and, also becoming tendinous, are inserted with them into crest of pubes and ilio-pectineal line to the extent of about an inch, completing conjoined tendon.

Fascia Transversalis – Part of the general layer of fascia which lines the abdominal & pelvic cavities. In the inguinal region it is thick and dense, and presents the following points of interest: –

AT CIRCUMFERENCE OF INTERNAL ABDOMINAL RING – It is prolonged into a tubular process of membrane, the *infundibuliform fascia*, which descends round the cord & testis, forming the *fascia propria* round the latter.

AT LOWER PART OF REGION – It is, –

In Front of Femoral Vessels – First thickened into an oblique band adherent to Poupart's ligament & termed the *deep crural arch*, and then continued downwards beneath Poupart's ligament in front of the vessels to form anterior wall of femoral sheath.
Externally to Femoral Vessels – Attached to outer part of Poupart's ligament, and continuous with fascia iliaca.
Internally to Femoral Vessels – Attached to crest of pubes & ilio-pectineal line behind conjoined tendon & Gimbernat's ligament.

That part of the fascia transversalis which lies above Poupart's ligament between outer border of rectus muscle & epigastric artery (Hesselbach's triangle) is interesting as being the part which forms a covering to direct inguinal hernia.

Subperitonial Areolar Tissue – More or less distended with fat. Forms a bed in which the epigastric artery passes upwards & inwards along lower & inner boundaries of internal abdominal ring; is continued into a loose sheath round the cord.

Peritoneum – Presents, before the superficial strata of the abdominal wall have been dissected, the two *Inguinal Fossæ, internal & external*, which fossæ correspond respectively to the external & internal abdominal rings, and are separated by an oblique crescentic fold of variable width & prominence formed by the epigastric & obliterated hypogastric arteries

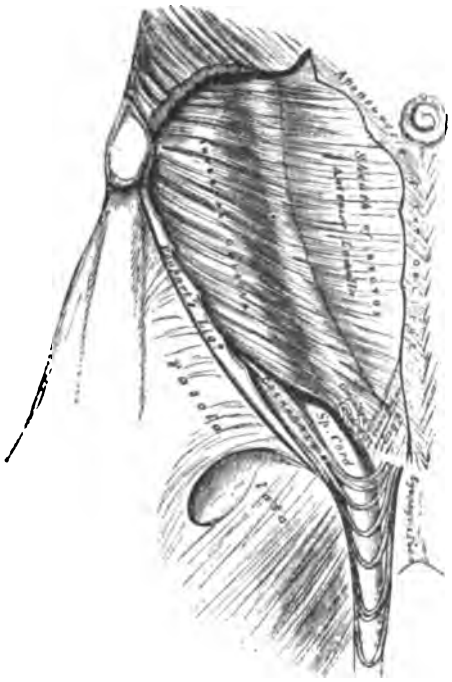


FIG. 280. INGUINAL HERNIA, SHOWING THE INTERNAL OBLIQUE, CREMASTER, AND INGUINAL CANAL. (Gray.)

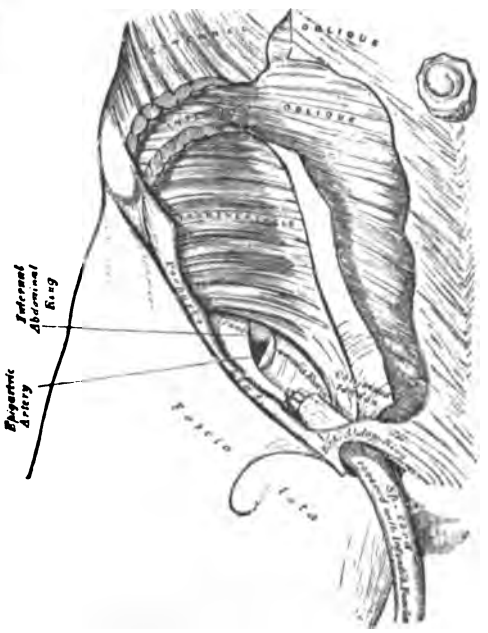


FIG. 281.—INGUINAL HERNIA, SHOWING THE TRANSVERSALIS MUSCLE, THE TRANSVERSALIS FASCIA, AND THE INTERNAL ABDOMINAL RING. (Gray.)

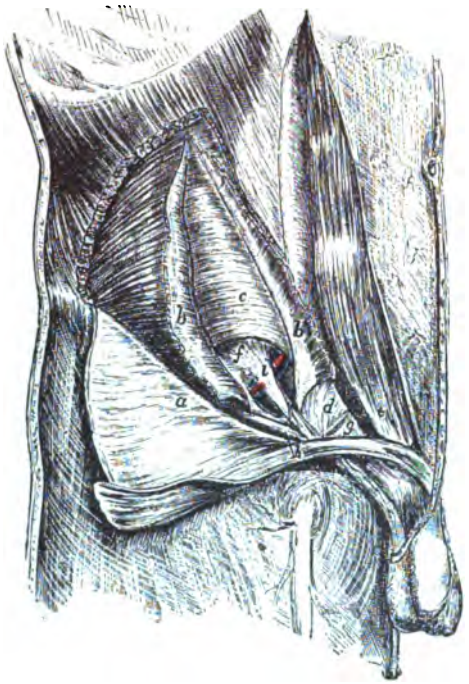


FIG. 282.—DEEP DISSECTION OF INGUINAL HERNIA. (Wood, Heath.)

a, external oblique muscle divided and turned down; *b*, *b*, internal oblique divided and turned aside; *c*, transversalis; *d*, conjoined tendon; *e*, rectus, with sheath opened; *f*, fascia transversalis; *g*, triangular ligament; *h*, cremaster; *i*, infundibular fascia and cord. The deep epigastric vessels are seen forming the inner boundary of the internal abdominal ring.

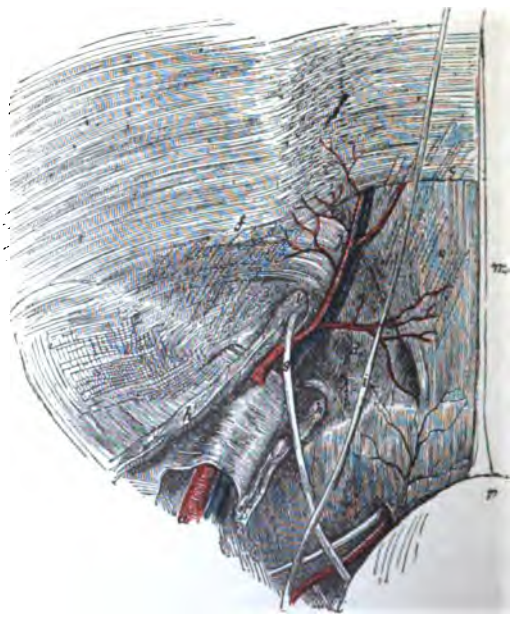


FIG. 283. THE INTERNAL ABDOMINAL & FEMORAL RINGS. (Wood, Heath.)

a, external iliac vessels; *b*, deep epigastric vessels; *c*, lower border of sheath of rectus (fold of Douglas); *d*, conjoined tendon in Hesselbach's triangle; *e*, rectus muscle; *f*, fascia transversalis; *g*, vas deferens; *h*, spermatic vessels; *i*, obliterated hypogastric artery; *k*, femoral ring, with lymphatics; *m*, urachus; *n*, bladder; *o*, obturator artery & nerve.

PARTS CONCERNED in INGUINAL HERNIA—2nd T.

INGUINAL OR SPERMATIC CANAL

Is an oblique passage 1½ or 2 inches long situated a little above, and parallel to, inner half of Poupart's ligament. It gives passage to the spermatic cord or round ligament, and presents for examination its two openings or rings, and its boundaries or walls.

External Abdominal Ring – Triangular & oblique downwards & inwards, about 1 inch long & ½ inch wide in male but rather smaller in female, bounded laterally by external & internal pillars, above by the intercolumnar fibres, below by the crest of the pubes. Gives off from its margin the intercolumnar or external spermatic fascia, which is prolonged into a tubular process around cord & testis (V. Abdominal Aponeuroses).

Internal Abdominal Ring – A tubular opening in the fascia transversalis formed by the prolongation of this fascia round the cord & testis (infundibuliform fascia, fascia propria), oval with large diameter directed downwards & outwards; situated midway between anterior superior spine of ilium & spine of pubes about ½ an inch above Poupart's ligament; bounded above & externally by the lower arched fibres of internal oblique & transversalis, below & internally by epigastric vessels.

Boundaries or Walls – Formed by:

In Front – Aponeurosis of *external oblique* along whole length; lowest fibres of *internal oblique* along outer third.

Behind – *Fascia transversalis* along whole length; *conjoined tendon* of internal oblique & transversalis, & also *triangular ligament* along inner third.

Above – *Arched fibres of internal oblique & transversalis.*

Below – *Poupart's ligament* blended posteriorly with fascia transversalis.

SURGICAL ANATOMY of INGUINAL HERNIA.

Principal points of interest are the coverings of the hernia, and the relations of the neck of the sac & of the seat of stricture. – For the rest see "Inguinal Hernia" among Tablets on Surgery.

COVERINGS — Differ in the oblique & direct forms, and are slightly modified also in the congenital & infantile varieties of the former, and in the external & internal varieties of the latter. They are as follows :—

OBLIQUE INGUINAL HERNIA

Of the Adult

FROM WITHIN OUTWARDS:

Peritoneum, subserous areolar tissue, infundibuliform fascia, cremasteric fascia, intercolumnar fascia, superficial fascia, skin.

FROM WITHOUT INWARDS:

Skin, superficial fascia, intercolumnar fascia, cremasteric fascia, infundibuliform fascia, subserous areolar tissue, peritoneum.

Congenital Variety – Descends directly into tunica vaginalis through pouch of peritoneum which accompanies cord & testis into scrotum, and which has abnormally remained *unclosed*. Its coverings are the same as those of testicle: – *Skin, dartos, intercolumnar fascia, cremasteric fascia, fascia propria, tunica vaginalis reflexa.*

Infantile Variety – Descends into the still patent upper part of the *imperfectly closed* pouch of peritoneum, and becomes more or less completely invested, especially in front, by the posterior part of the tunica vaginalis reflexa. Its coverings are *the same* as those of foregoing variety *with two additional layers of peritoneum*

DIRECT INGUINAL HERNIA

Internal or Common Variety – (Protrudes through inner part of Hesselbach's triangle, on inner side of obliterated hypogastric artery).

FROM WITHIN OUTWARDS:

Peritoneum, subserous areolar tissue, fascia transversalis (the general f. tr., not the infundibuliform process) *conjoined tendon (or not,* since it is frequently ruptured instead of being pushed forwards) *intercolumnar fascia, superficial fascia, skin.*

FROM WITHOUT INWARDS:

Skin, superficial fascia, intercolumnar fascia, conjoined tendon (or not), fascia transversalis, subserous areolar tissue peritoneum.

External Variety – (Protrudes through outer part of Hesselbach's triangle, on outer side of obliterated hypogastric artery, & externally to the conjoined tendon) – This exceptional form of inguinal hernia, passes through a considerable portion of the inguinal canal, and greatly resembles the oblique hernia both by presenting a certain degree of obliquity and by having very nearly the same coverings; the covering derived from the cremasteric fascia is alone rather less complete.

RELATIONS OF NECK OF SAC & SEAT OF STRICTURE —

The neck of the sac lies

IN OBLIQUE INGUINAL HERNIA – *On outer side of epigastric artery and in front of spermatic cord,* the elements of which may, however, be more or less scattered round the neck of the sac.

IN DIRECT INGUINAL HERNIA – *On inner side of epigastric artery, in front & slightly on inner side of spermatic cord.*

On account of the uncertainty of the diagnosis between the oblique & direct hernias it is an accepted rule in surgery to divide a deep seated stricture *directly upwards from middle of upper margin of constricting ring,* that is to say in the direction of the epigastric vessels.

THE ISCHIO-RECTAL REGION.

Corresponds to the portion of outlet of pelvis situated behind a line drawn from front part of one tuber ischii to that of the other. It is bounded in front by above mentioned line; its apex is at point of coccyx; its sides are formed by tuberosities of ischium, great sacro-sciatic ligaments & great glutei muscles.

It contains terminal portion of rectum surrounded by levatores ani and the internal & external sphincters, and on each side of which is the ischio-rectal fossa.

It is triangular in form and depressed centrally towards anus, round which aperture the integument is thrown into numerous folds, and becomes continuous with mucous membrane of intestine.

The skin is dark, but thicker & less movable than on perinæum proper, and contains a few hair-follicles.

The subcutaneous areolar tissue or superficial fascia hardly exists in centre of region, or over sphincter ani, which muscle is closely adherent to integument; but it is abundant laterally, where it is loaded with a large amount of fat, and where it dips into and fills the ischio-rectal fossa.

ISCHIO-RECTAL FOSSA

Is a large excavation which sinks deeply into pelvis on either side of rectum, and which is filled with a considerable amount of loose fatty areolar tissue.

It is wide & triangular at its

Base, – Which corresponds to integument, but it is flattened from side to side and diminished in size superiorly. – Its

Inner Wall – Is oblique downwards & inwards and formed by under surface of levator ani & by sphincter, which muscles are covered by anal fascia.

Outer Wall – Is vertical, and is formed by obturator internus covered by obturato fascia; it presents the pudic vessels & nerve enclosed in a sheath of fascia.

It is bounded:

Above – By junction of anal & obturator fascia.

In Front – By junction of the same fasciæ superiorly, and, inferiorly, by junction o the superficial & deep perinæal fasciæ behind transversus perinæi.

Behind – By sacro-sciatic ligaments, coccygeus & the gluteus maximus.

The vessels & nerves it contains are the:
Inferior hæmorrhoidal, in the centre;
Pudic, in the outer wall;
Superficial perinæal, in front;
A branch of 4th sacral nerve, and branches of sciatic artery & small sciatic nerve, behind; the branches of the latter nerve winding round lower border of gluteus maximus.

Above levator ani is the recto-vesical layer of the pelvic fascia (Vide Pelvic F.)

THE MALE PERINÆUM.

Consists of the structures which close outlet of pelvis anteriorly to line drawn from front part of one tuber ischii to that of the other

It is triangular in form, and is bounded laterally by rami of pubes & ischia and posteriorly by above mentioned line. The width of its base (rather the smallest side of the triangle) is usually about 2½ inches in the male adult, but it is sometimes considerably reduced; the operation of lateral lithotomy is then greatly impeded.

The part is convex in middle line & slightly depressed laterally, and presents the following layers:

Skin – Thin, dark, freely movable, marked by a prominent median *raphé*, studded with thin crisp hairs, and provided with numerous sebaceous follicles.

Superficial Fascia – Divided into two layers.

SUPERFICIAL LAYER – Thick, areolar, contains a large amount of fat, and is continuous with subcutaneous tissue of surrounding regions.

DEEP LAYER – Thin & aponeurotic; lies in close contact with the muscles.

On either side it is attached to rami of pubes & ischia externally to crura penis;

Behind it is connected to central tendinous point of perinæum; and is prolonged beneath sphincter ani, becoming continuous behind transversus perinæi & in front of rectum with inferior layer of deep perinæal fascia;

In front it is unattached, & continuous with dartos;

Superiorly it gives off a median septum, which is rather deficient in front but pretty well marked behind.

It binds down the superficial structures, and bounds inferiorly, and also, through its attachments, laterally & behind, a space, in which if urine be effused, this fluid will be directed forwards towards the scrotum, and the lower part of abdomen, and prevented from passing backwards towards anus, or outwards towards thighs. This layer is sometimes called the *superficial perinæal fascia*.

Superficial Genito-Urinary Muscles – Are the:

ERECTOR PENIS – Covering the crus;

ACCELERATOR URINÆ OR EJACULATOR SEMINIS – Spreading out upon bulb of urethra;

TRANSVERSUS PERINÆI – Separating perinæum proper from ischio-rectal region.

These muscles bound a triangular area, which is crossed superficially by the superficial perinæal vessels & nerve, behind which area passes transversely inwards the transverse perinæal artery, and through which area can be seen deeply the superficial layer of the deep perinæal fascia. In lateral lithotomy the knife is carried backwards & outwards through inner & back part of this area on left side.

Inferior Layer of Deep Perinæal Fascia, or Triangular Ligament of Urethra – Vide below.

Membranous Portion of Urethra, Compressor Urethræ, & Deep Transversus Perinæi, Pudic Vessels & N., Vessels & N. of Bulb, Cowper's Glands & their Ducts – Vide these parts.

Superior Layer of Deep Perinæal Fascia –

The deep perinæal fascia is a complex structure triangular in form, which supports the urethra, and closes anterior part of outlet of pelvis.

On either side it is attached to rami of pubes & ischia internally to crura penis;

Behind it is connected to central tendinous point of perinæum, and is continuous both with thin fascia on under surface of levator ani, and, behind transversus perinæi, with deep layer of superficial fascia of perinæum;

In front it is attached to pubic arch & sub-pubic ligament.

It consists of two aponeurotic layers which are separated in the centre, but united laterally & behind; of these two layers the

ANTERIOR, INFERIOR, OR SUPERFICIAL LAYER – The thickest, is continued downwards & forwards upon anterior part of membranous portion of urethra, and is lost upon the bulb. This layer is perforated by the *urethra* about an inch below symphysis pubis, by *dorsal vein of penis* in front of urethra, & by *pudic vessels & nerve* on either side of the vein; it is the only layer that can properly be called the triangular ligament of the urethra, though the term is sometimes applied to both layers taken together.

POSTERIOR, SUPERIOR, OR DEEP LAYER – Thinner. Is continued upwards & backwards round posterior part of membranous portion of urethra, and becomes continuous with pelvic fascia.

Between these two layers are comprised the parts above mentioned, viz., *membranous portion of urethra* with *compressor urethræ & deep transversus perinæi muscles, pudic vessels & nerve* with *vessels & nerve of bulb, Cowper's glands & their ducts.*

Above these parts are found in centre of perinæum the

Prostate Gland & Neck of Bladder, – and laterally the

Anterior Part of Levator Ani & of Pelvic Fascia – The latter fascia is continued posteriorly upon posterior part of levator ani, upon rectum & between it & bladder, and belongs as much to ischio-rectal region as to the perinæal.

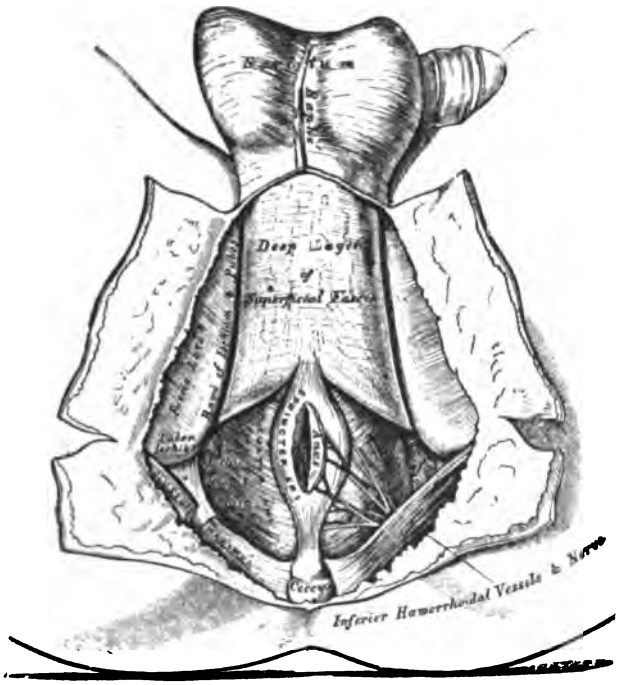


FIG. 284.—THE PERINÆUM: THE INTEGUMENT AND SUPERFICIAL LAYER OF SUPERFICIAL FASCIA REFLECTED (Gray.)

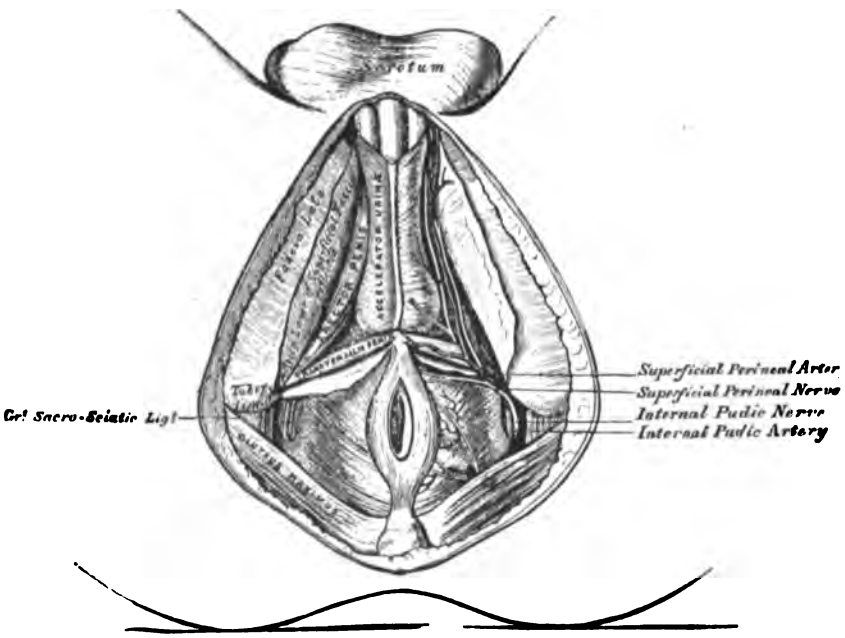


FIG. 285.—THE SUPERFICIAL MUSCLES AND VESSELS OF THE PERINÆUM (Gray.)

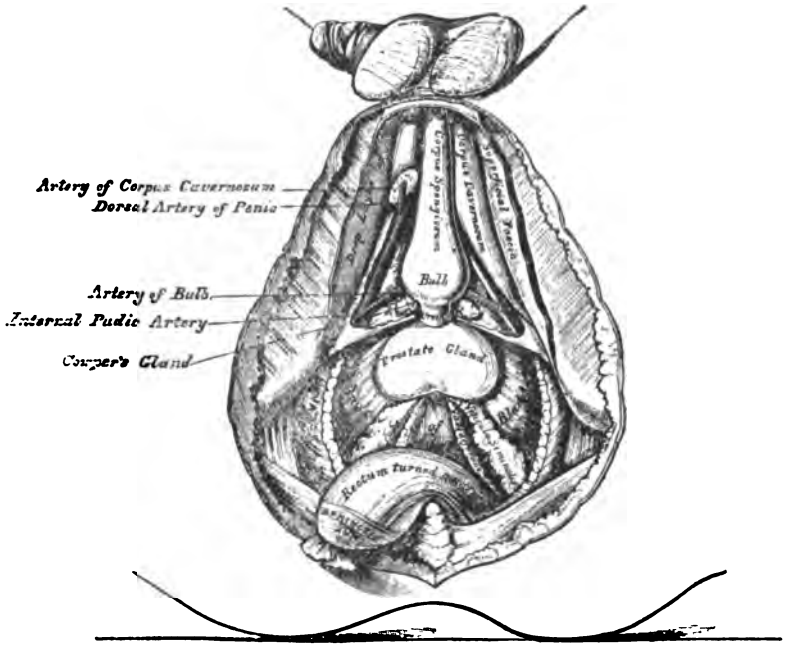


FIG. 286.—A VIEW OF THE POSITION OF THE VISCERA AT THE OUTLET OF THE PELVIS. (Gray.)

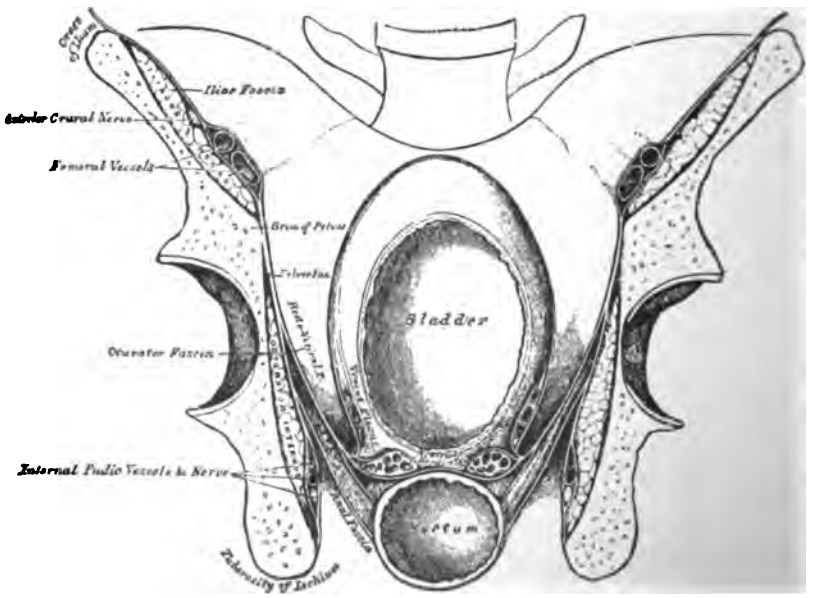


FIG. 287.—A TRANSVERSE SECTION OF THE PELVIS, SHOWING THE PELVIC FASCIA. (Gray.)

MUSCLES of the MALE PERINÆUM.

ANAL GROUP.

Sphincter Ani – Tip & back of coccyx and superficial fascia in front of it.
Central tendinous point of perinæum blending with accelerator urinæ, transversus perinæi & levator ani. – S. by inferior hæmorrhoidal branch of pudic, & by anterior division of 4th sacral nerve.

Levator Ani – Back of pubes close to symphysis, spine of ischium, and, between these two points, from a white band or thickening of the pelvic fascia which marks point of division of the latter fascia into obturator & recto-vesical layers.
Side & apex of coccyx, median raphé between coccyx and anus, side of lower part of rectum blending with sphincter ani, and decussates with its fellow in front of rectum and below & behind the prostate forming the so-called levator prostatæ, which latter fasciculus is sometimes separated from the remainder of the muscle by a little areolar tissue. – S. by anterior division of 4th sacral n.

Coccygeus – Spine of ischium & lesser sacro-sciatic ligament.
Side of coccyx and of lower piece of the sacrum. – S. by anterior divisions of 4th & 5th sacral nerves.

Internal Sphincter – Is a thickened circular band of the unstriped muscular fibres of the intestine.

GENITO-URINARY GROUP.

Accelerator Urinæ, Ejaculator Seminis, or Bulbo-cavernous – Central tendinous point of perinæum & median raphé in front of it.
Its posterior fibres are inserted into the triangular ligament; its middle fibres decussate above the bulb & corpus spongiosum which they encircle; its anterior fibres are partly inserted into the corpus cavernosum, and partly joined above it in a tendinous expansion which covers dorsal vessels & nerves of penis. – S. by superficial perinæal nerve.

Erector Penis, or Ischio-cavernous – Inner aspect of tuberosity of ischium behind crus penis and pubic arch on either side, back part of under surface of the crus.
By a tendinous expansion into fore part of under & outer surfaces of crus penis. – S. by superficial perinæal nerve.

Transversus Perinæi – Inner & fore part of tuberosity of ischium.
Central tendinous point of perinæum blending with its fellow, the accelerator urinæ, & sphincter ani. – S. by superficial perinæal nerve.

Compressor, or Constrictor Urethræ – Upper part of pubic arch on either side of symphysis.
Its fibres surround membranous portion of the urethra, decussating above & below it. – S. by pudic nerve.

Deep Transversus Perinæi – Is a thin fasciculus which may or may not be separated from posterior fibres of foregoing muscle. It decussates with its fellow behind the bulb, and covers Cowper's gland.

PUDIC ARTERY.

The smaller of the two terminal branches of anterior division of internal iliac artery.

Descends in front of pyriformis & sacral plexus, lying to the inner side & a little in front of sciatic artery.

With pudic nerve through lower part of great sacro-sciatic foramen below pyriformis on inner side of sciatic nerves & sciatic artery.

Winds round spine of ischium and re-enters pelvis through lesser sacro-sciatic foramen.

Forwards along outer wall of ischio-rectal fossa below pudic nerve, being covered by obturator fascia, and lying at first 1½ inches above lower extremity of tuber ischii, but approaching surface as it progresses.

Pierces deep layer of deep perineal fascia, and ascends along pubic arch between the two layers of that fascia to near symphysis pubis.

Pierces superficial layer of deep perineal fascia, and divides into artery of corpus cavernosum and dorsal artery of penis.

Gives off *Inferior Hæmorrhoidal, Superficial Perineal, Transverse Perineal, & Artery of the Bull.*

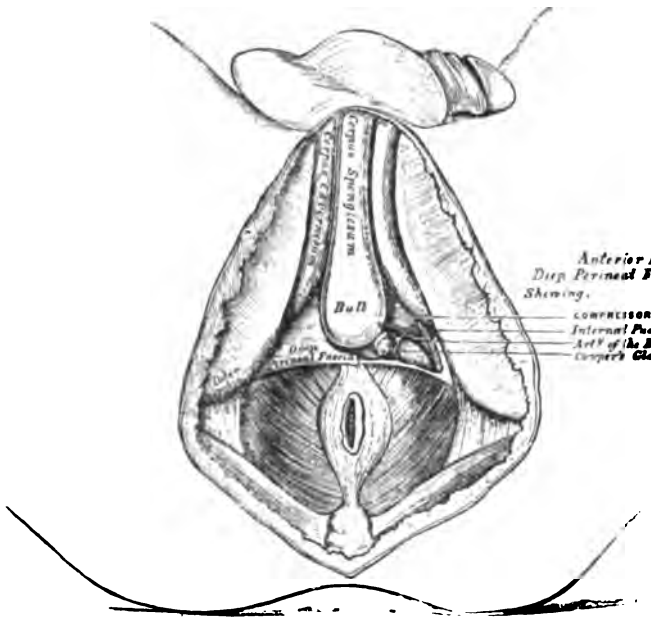


FIG. 288.—DEEP PERINÆAL FASCIA; ON THE LEFT SIDE THE ANTERIOR LAYER HAS BEEN REMOVED. (Gray.)

(For Pudic Artery, see also Figs. 235, 236, 237, and 238.)

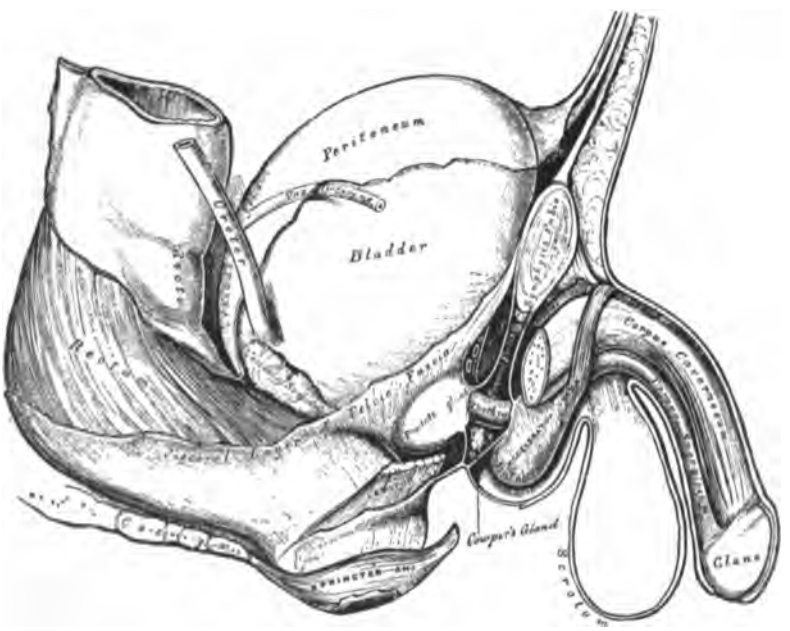


FIG. 289.—SIDE VIEW OF THE PELVIC VISCERA OF THE MALE SUBJECT, SHOWING THE PELVIC AND PERINÆAL FASCIÆ. (Gray.)

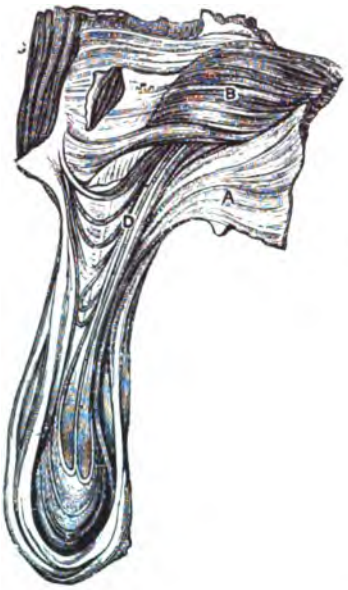


FIG. 289A.—B, D, THE INTERNAL OBLIQUE AND CREMASTER MUSCLES. (Ellis.)
A, EXTERNAL OBLIQUE MUSCLE TURNED DOWN; C, RECTUS.

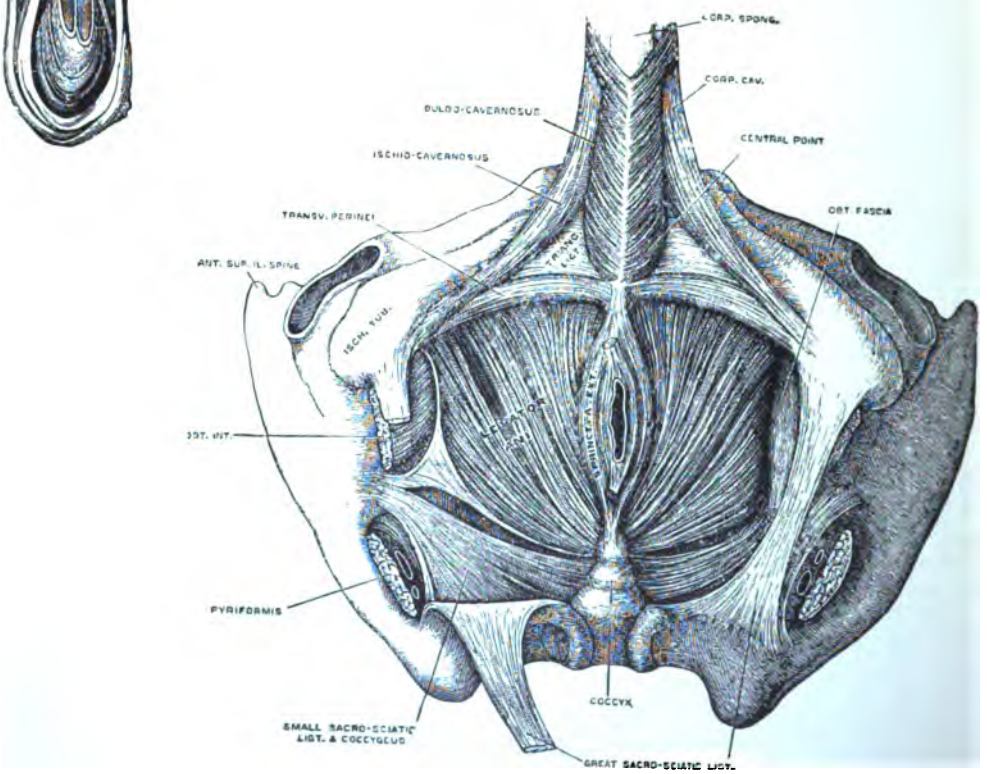


FIG. 290.—MUSCLES OF THE MALE PERINÆUM. (Henle.)

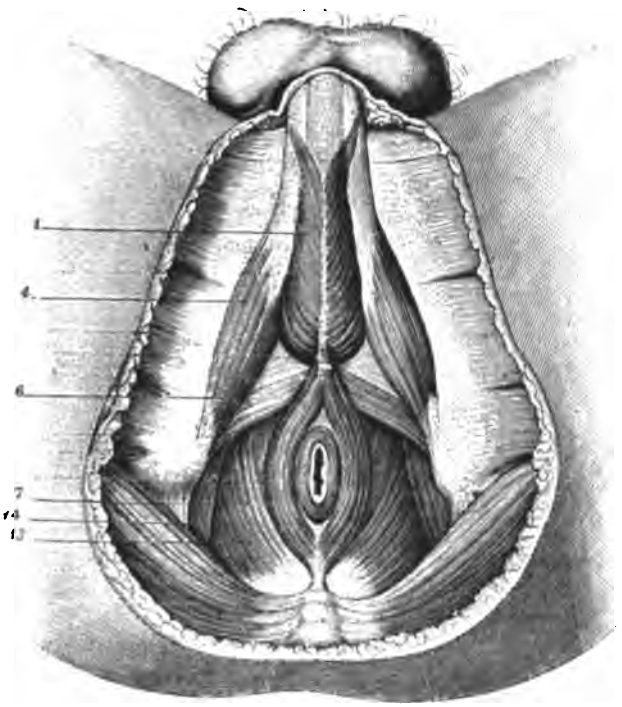


FIG. 291. —MUSCLES OF THE MALE PERINÆUM. (Sappey.)
1, accelerator urinæ; 4, erector penis; 6, transversus perinæi; 7, sphincter ani; 13, levator ani; 14, obturator internus.

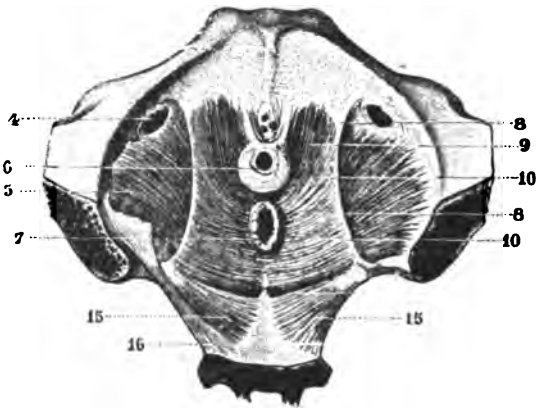


FIG. 292.—LEVATOR ANI, 9, 10; COCCYGEUS, 15; OBTURATOR INTERNUS, 5. (Sappey.) (See expl., p. 96h.)

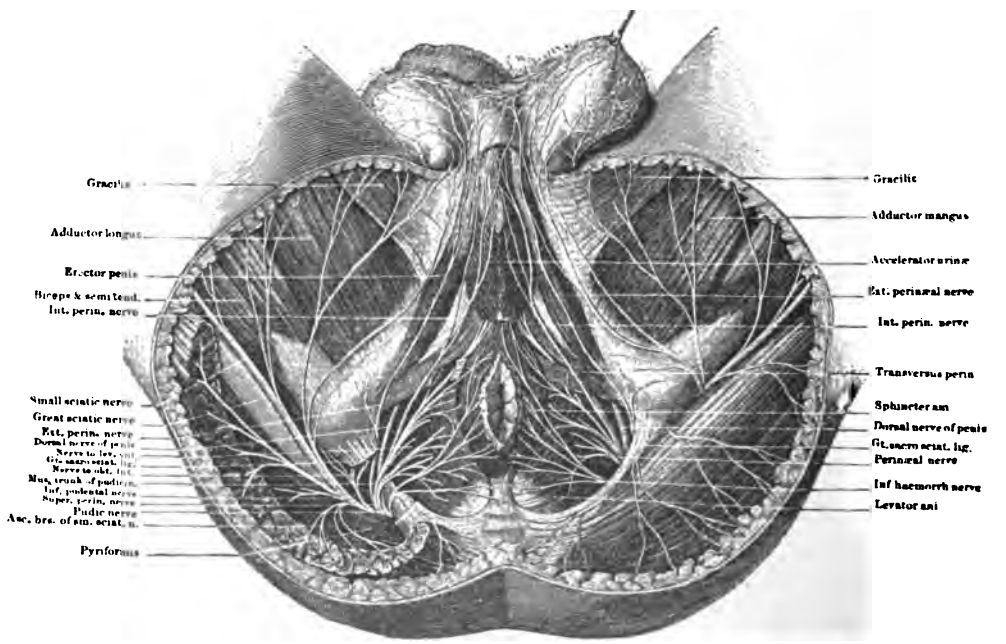


FIG. 293.—THE SACRAL PLEXUS. (Cruveilhier, after Hirschfeld.)
(See also Figs. 353, 354, 355, and 357.)

PUDIC NERVE.

From lower part of sacral plexus.

With pudic artery through lower part of great sacro-sciatic foramen on inner side of great sciatic nerve.

Winds round spine of ischium, and re-enters pelvis through lesser sacro-sciatic foramen, where it gives off inferior hæmorrhoidal nerve.

Forwards along outer wall of ischio-rectal fossa above pudic artery, both nerve & artery being covered by obturator fascia, and divides into perineal nerve & dorsal nerve of the penis

(Vide p. 293).

PARTS CONCERNED in LATERAL LITHOTOMY.

Parts to be divided: -

1. *Integument, superficial fascia, inferior hæmorrhoidal vessels & nerve;*
2. *Posterior fibres of accelerator urinæ & transversus perinæi muscles; probably also the transverse perinæal artery and superficial perinæal vessels & nerves.*
3. *Deep perinæal fascia, left deep transversus perinæi muscle & posterior fibres of compressor urethræ; the anterior fibres of levator ani;*
4. *Membranous & prostatic portions of urethra, and part of prostate gland.*

Parts to be avoided: -

1. *The bulb and its artery* are endangered if incision is begun too far forwards; - if the artery arises further back than usual it is exposed to be divided whatever care be taken;
2. *The rectum* is endangered if incision is begun too far inwards;
3. *The pudic artery*, if incision is carried too far outwards;
4. *Entire breadth of prostate with prostatic veins & accessory pudic artery, if the latter exist*, may be divided if incision into the deep parts is carried too far backwards, and the urine may then become infiltrated between the bladder & rectum.

I.—LIGAMENTS, FASCIÆ, &c.—Mr. SUTTON'S VIEWS.

The principal tendons, ligaments, and fasciæ result from the regression either of muscles, migrated or otherwise, or of osseous or cartilaginous structures.*

I. - Regression of Muscles.

When muscle fails to act to advantage, it degenerates into tendon, ligament, or fascia. As a rule tendons are situated at the extremities of muscles, where contractile tissue would have little opportunity of exerting itself to advantage. When a tendon develops in the centre of a muscle, as in the case of the digastric, it is in a situation where contractile tissue would be of little avail.

The following rules may be laid down in forming conclusions as to whether any particular band of fibrous tissue represents a degenerated muscle: - It should correspond to its presumed representative in origin and insertion. It should occasionally reappear as an anomaly in the human subject, or should at least assume a functional importance in other animals: Thus the band of fascia which arches over the ulnar nerve at the back of the elbow, - extending from the back of the inner condyle to the olecranon, - is undoubtedly the degenerated epitrochleo-anconeus, - a muscle frequent in mammals, and occasionally present in man.

Deep Fascia of the Limbs.

The ilio-tibial band which continues the tensor fasciæ femoris, is the representative of the lower fleshy portion of the muscle, which, in some animals, is prolonged as far as the knee. The strong fascia on the outer and back part of the thigh, below the fold of the buttock, is the degenerated lower part of the gluteus maximus. There are instances, conversely, in which the bicipital or semilunar fascia is replaced by a thin layer of muscle.

Abdominal Aponeuroses.

The *anterior abdominal aponeurosis* results from the regression of the ventral portion of the external and internal obliques and transversalis: these large tendinous tracts are represented by well-marked muscular sheets in amphibians, ophidians and lizards.

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* It is hoped that the few following pages, condensed, as far as human structures are primarily concerned, from Mr. Sutton's "Ligaments; their Nature and Morphology," may induce all who read them to study this most admirable little book as a whole. It is a model, from every point of view, of what such an exposé should be, - simple, unpretending, direct, and eloquent, and a masterly exposition of one of the broadest generalisations, after Darwin's and Gaskell's, which have marked the progress of modern Anatomy. The book should be read by every student of Anatomy.

The *posterior layer* of the lumbar fascia results from the regression of the lower fibres of the latissimus dorsi: in many animals this layer is replaced by fleshy fibres continuous with the main muscular sheet. The *middle layer* of the lumbar fascia is particularly interesting. This layer contains, and is perhaps entirely made up by, the degenerate remains of the lower representatives of the levatores costarum: if in a fresh subject the structures of the loin be removed down to the quadratus lumborum muscle, these remains will be seen as fan-shaped arrangements of fine fasciculi arising from the tips of the upper lumbar transverse processes, passing downwards and outwards, and recalling in appearance the nacreous fibres of origin of the serratus posticus superior (See plate 56 in Morris's Anatomy). The lowest of these fibrous thickenings form the lumbo-sacral and lumbo-iliac ligaments. The *anterior layer* of the posterior abdominal aponeurosis results from the regression of the posterior portion of the transversalis muscle. In bodies presenting a lumbar rib the fan-shaped ligament starting from the twelfth dorsal vertebra is often replaced by a functional muscle.

Palmar Fascia.

The palmer fascia results from the regression of the distal end of the palmaris longus muscle, and there is good reason to believe that the abductors pollicis and minimi digiti, and the palmaris brevis, are but less degenerated portions of the same muscular plane. The palmaris longus was at one time quite an extensive structure, and still is so in the armadillo and the aard vark. It is here fleshy throughout, sends slips to all the digits, and is one of the chief agents in flexing the same. Portions of the original muscle not unfrequently reassert their former character even in man. This is especially the case with the strips to the thumb. As all degenerating structures, the palmaris longus varies much. It has occasionally two bellies with an intervening tendon; it may end in the fascia of the forearm; it may be wholly represented by a ligament; it is found altogether absent in about one case in ten.

Plantar Fascia.

The plantar fascia results from the regression of the plantaris muscle; and some of the short muscles of the first layer of the sole of the foot, (the abductor hallucis excepted, which is a migratory muscle, to be considered later on) are but detached and less degenerated portions of the muscular plane referred to. The remarks on the palmaris longus again apply here. In the armadillo the plantaris is larger than the gastrocnemius, its fleshy belly extending over the whole of the calf; at the heel it forms a tendon which glides in a well marked groove on the back of the os calcis; in the sole of the foot it spreads out into the fascia in question, and sends slips to the toes, as far as their terminal phalanges. In man the plantaris is but a vestigial structure. Its vagaries alone would indicate its high origin: it may join the plantar fascia, the internal annular ligament, the deep fascia, or may be entirely wanting.

Calcaneo-cuboid Ligaments.

The long and short plantar, or calcaneo-cuboid ligaments, result from the regression of a wide deep plane as extensive as, if not more extensive than, the superficial plane above referred to which deep plane includes the muscles of the third layer of the

sole of the foot (the transversus pedis excepted), the gastrocnemius and soleus, the above-named ligaments, and the tendo Achillis. This wide continuity will be gathered, with reference to the distal part of the muscular plane in question, from the dissection of the foot of the seal. The same will appear, in reference to the proximal part of the plane, from the examination of the fœtal foot of either man, horse, or deer. Up to the sixth month, in the human fœtal foot, a saggittal section through the tendo Achillis, the os calcis and the cuboid will show the tendo Achillis and the above-mentioned ligaments forming one continuous band, the attachment of which to the back part of the os calcis is of the loosest kind. It is only after the seventh month that the gradual extension of the os calcis backwards segments the plane at the level of the tuberosities of that bone. The case of the horse and the deer differ from that of man merely in the evident forecasting of the adult form, in which the blended ligaments pass from the back part of the os calcis to the cuboid and the rudimentary external metatarsal bone.

The degenerated *abductor ossis metatarsi quinti* is well known as a stout fibrous band extending from the outer tuberosity of the os calcis to the base of the fifth metatarsal bone. It is said to be present as a muscle in man, in one "subject" out of two. It is constant in many of the quadrumana.

Interosseous Membrane of the Leg

Is the representative of the peroneo-tibial muscle of sphenodon, chameleon, gecko, and the like, and of the wombat, which muscle is made up of more or less horizontal fibres extending from the tibia to the fibula. The popliteus of man and the rotator fibulæ of the gibbon are probably but less degenerated remnants of the same. The anterior interosseous arteries and nerves are tunnelled over by thin scattered fibres through the degeneration of the muscle they once supplied. The interosseous membrane of the forearm has probably a similar origin.

The posterior sacro-coccygeal ligaments in man represent the extensores coccygis of the anthopomorphæ, or the extensor of the caudal vertebræ in other vertebrates.

In man, the place of these ligaments is sometimes occupied by muscle.

Albinus, in his "Historiæ Musculorum," notes three instances of the Curvatores Coccygis muscles in man extending from the front of the fourth and fifth sacral vertebræ to the front of the coccyx.

The Coraco-brachialis Muscle.

Morphologically, this muscle consists of three separate portions, – superior, middle, and inferior, – the relative development of which varies a great deal both in mammals generally and in man.

The *superior portion*, – coraco-brachialis superior, – is inserted into a fibrous loop extending from the coracoid process to the lesser tuberosity of the humerus. It may develop into a distinct muscle, the rotator humeri.

The *middle portion*, – coraco-brachialis medius or proprius. – is the coraco-brachialis of ordinary human anatomy It is this portion that is traversed by the musculo-cutaneous nerve.

The *inferior portion*, – coraco-brachialis longus, – usually degenerates into the fibrous band, which we commonly call the internal intermuscular septum. It may,

however, take the shape of a well-marked muscular belly extending from the coracoid process to the inner condyle of the humerus.

II. - Migration of Muscles.

Muscles may change their position by shifting either their origin or their insertion, or both. As a rule the origin is more subject to variation than the insertion.

The *extensor brevis digitorum* originally belonged to the peroneal group, and arose from the fibula. This is its condition in monotremata. But as we ascend the scale of mammalian forms, we see the muscle passing down tendon by tendon until it reaches the still imperfect condition presented in the human foot: The peroneus tertius in man is but the outer tendon of the extensor brevis, which has failed to migrate with its companions. In many mammals a slightly lower condition is present: there are two tendons, instead of one, that arise from the fibula, and they gain the dorsum of the foot by passing behind the external malleolus.

The *abductor hallucis*, again alluded to further on, is also an emigrant, it having descended from the tibia to its present position on the os calcis.

In the early embryo the *dorsal interossei* muscles are plantar in position, and possess but one head; and the metatarsals are in contact with each other. Gradually the metatarsals separate, and the interossei make their way between them, and, becoming bipenniform, eventually appear on the dorsum of the foot.

As muscles migrate, they often leave some part of their structure behind them, transformed into ligament. Up to the fourth month of fœtal life the *adductor magnus* was inserted into the head of the tibia. Later, migration occurs, the muscle proper becoming attached to the condyle of the femur, whilst the distal tendinous portion becomes the internal lateral ligament of the knee-joint.

The *external lateral ligament of the knee-joint* is the tendon the peroneus longus, which has gradually separated from the fleshy belly of the muscle, and has formed a new attachment to the head of the fibula; in the gibbon the tendon of the peroneus longus arises from the external condyle of the femur, and replaces the ligament. Even in man the muscular fibres of the peroneus longus often have an extensive origin from the ligament.

There is reason to believe that the internal and external lateral ligaments of the ankle-joint have arisen in a similar manner.

The *round ligament of the hip-joint* has long been an anatomical puzzle. There is no ligament that can boast of such an extensive literature, or of having exercised so much the ingenuity of physiologists and surgeons. It is best regarded as the divorced tendon of a muscle, – in all probability of the pectineus, – from which it has become separated in consequence of skeletal modifications. The ambiens muscle of the thigh of birds, the representative of the human pectineus, is distinctly seen in the ostrich chick to be continuous with the ligamentum teres. In sphenodon, the muscle which corresponds to the ambiens of birds and to the human pectineus, has two heads, of which one lies

entirely within capsule of the joint. In the horse the ligamentum teres consists of two portions; one is hidden within the joint; the other passes out of the joint cavity, and gives attachment to the fibres of the pectineus.

The *interarticular fibro-cartilages and crucial ligaments of the knee-joint* are metamorphosed tendons which were drawn in between the opposed surfaces of the tibia and femur when aquatic life was exchanged for the terrestrial. In the tailed batrachians, such as menobranchus and ceratodus, the hind limbs, used as paddles, are mainly kept extended, the muscles of the pes arise almost exclusively from the femur, and there are in the knee-joint neither crucial ligaments nor interarticular fibro-cartilages. Already in the semi-terrestrial frog the bending of the limb at acute angle involves a more complex knee-joint. Here we find an internal interarticular fibro-cartilage continuous with the muscular mass corresponding to the semi-membranosus. As we ascend the scale, we find, on the one hand, the higher type evolved, and, on the other, the muscles destined for the pes taking their origin no longer, in the main, from the femur, but almost exclusively from the tibia and fibula. As, in flexion, the upper part of the tibia is brought into contact with the tendons of origin of the muscles destined for the pes, these are drawn by degrees into the joint, and become the crucial ligaments and the semi-lunar fibro-cartilages.

A general survey of the segmentation of the muscles of the lower limb may perhaps be introduced here with advantage. In the primitive forms, like lepidosiren, the muscular layers pass from the trunk to invest the lower limb, both limbs in fact, without any transverse segmentation occurring. In frogs, lizards, and crocodiles, a gap occurs at the knee in the muscular sheet, the proximal segments attaching themselves to the tibia and fibula, while the distal segments come to arise from the lower end of the femur. The quadriceps extensor, sartorius, gracilis, the hamstring group, and the adductor magnus thus become inserted into the bones of the leg, while the extensors and flexors of the digits, the peroneal group, the gastrocnemius and plantaris, and both tibiales arise from the femur. But, on the one hand, many of the proximal musles, *e.g.*, the adductor magnus, have since formed new attachments to the femur; and, on the other hand, many of the distal muscles have abandoned their first origin and have migrated to the tibia and fibula, *e.g.*, the peroneus longus.

It is unfortunately not quite clear to which muscles the crucial ligaments owe their origin. The possible muscles are, however, but some three or four—namely, the flexor longus and the extensor longus digitorum, the tibialis posticus, and the peroneo-tibial.

The synovial membrane of the knee-joint presents four component parts. These are the synovial membranes of the two femoro-tibial condyloid articulations, that of the femoro-patellar arthrodia, and the synovial bursa between the femur and the quadriceps extensor femoris, which latter, in the fœtus, communicates by a small opening

only with the general synovial cavity. In the beaver there is a distinct synovial pouch for the patella and the patellar surface of the femur, and the synovial membranes of the femoro-tibial joints are completely separated from each other by the crucial ligaments and a septum of connective tissue. This septum represents the ligamenta mucosum and alaria of man.

Man's knee-joint has therefore been the theatre of [1] Retrogression and migration of muscles, providing it with ligaments; [2] Metamorphosis of tendons, providing it with interarticular fibro-cartilages; [3] Annexation of bursæ, extending its synovial territory

III. - Ligaments arising from the Retrogression of Osseous and Cartilaginous Structures; Bones arising from the ossification of ligaments.

In Ornithodelphia and Didelphia the inner pillar of the external abdominal ring is ossified to form the marsupial bone.

In many carnivora the tentorium cerebelli is replaced by a plate of bone. In some turtles the temporal fascia is also osseous.

There are numerous cases on record in which the first rib in man was merely a fibrous band extending to the sternum; the fibula also may be replaced by ligament.

Supra-condyloid Foramen.

In carnivora, rodents, and others, their exists above the inner condyle of the humerus a bony tunnel known as the supra-condyloid foramen, which transmits, as a rule, the brachial artery and the median nerve. In the young lion at birth, as also in the fœtal cat, this foramen is formed in part by a downgrowth from the diaphysis, and in part by an upgrowth from the epiphysis. In man the most frequent condition of this foramen, when it exists, is that the upper part of the ring is formed as above, and the lower part by a band of fibrous tissue descending from the same to the condyle.

In the mole, the upper end of the tendon of the biceps plays in a very perfect osseous tunnel; in man it plays in a groove arched over by dense fibrous tissue.

Lesser Sacro-sciatic Ligament.

In armadilloes and other edentata, the ischial spine comes in contact with the ateral portions of the pseudo-sacral vertebra, and completes the great sacro-sciatic foramen. Regression of this large ischial spine would explain one mode of origin of the lesser sacro-sciatic ligament. There is, however, reason to believe that, in man, this ligament is derived from the coccygeus muscle.

Great Sacro-sciatic Ligament.

This is the expansion of the tendon of origin of the hamstring muscles, and more particularly of the biceps and semi-tendinosus. A little dissection will show the continuity of these structures. The tendon is tensed by pulling on the muscles. The coccyx may even be moved by pulling upon the biceps.

The Typical Shoulder Girdle.

Consists of (1) a dorsal segment, the scapula; (2) a ventral bar of cartilage, the coracoid, forming with the scapula a socket for the reception of the head of the humerus; and (3) another rod or bar of cartilage situated anteriorly to the coracoid, and named the precoracoid. These two latter segments agree in the circumstance that they meet the sternum anteriorly and the scapula posteriorly; the precoracoid is usually excluded, however, from the glenoid cavity. There is frequently another bar of cartilage, the epicoracoid, which unites the ventral ends of the coracoid and precoracoid.

By the two processes of addition and suppression, – the suppressed parts remaining represented by fibrous tissue, – it is easy to derive any form, from chelonian to man, from the above original type.

Man's pectoral girdle differs from the above type mainly in the absence of continuity of the coracoid and precoracoid bars.

The suppressed continuity of the precoracoid is due to the intrusion, in the centre of the same, of the clavicle, as a secondary element of ossification. The central extremity of the precoracoid then becomes the interarticular fibro-cartilage of the sterno-clavicular articulation, – in which there is sometimes found a little hyaline cartilage or even occasionally an osseous nodule (episternal bone of Breschet). The scapular remnant of the same similarly finds a representative in the interarticular cartilage sometimes met with in the acromio-clavicular articulation.

The discontinuity of the coracoid bar must also be attributed to a process of partial suppression. Its well-known prolongation in frogs, birds, and monotremes is merely represented in man by the long costo-coracoid ligament which runs along the free border of the membrane of that name, and which often presents a few chondral nodules at its sternal attachment. The coracoid in man is but a stunted process, which fuses early with the scapula.

Interarticular Fibro-cartilage of the Sterno-clavicular Articulation - is, as above explained, the remains of the anterior or ventral end of the precoracoid bar.

Interarticular Fibro-cartilage of the Acromio-clavicular Articulation [when present] - is the remains of the outer end of the same.

The ossification of the clavicle commences extremely early (fifth week) before the completion of the precoracoid bar, so that the bone is primarily a membrane bone. The ossification subsequently invades all the middle part of the precoracoid bar, and sometimes its outer extremity as well, – there being then no interarticular fibro-cartilage in the acromio-clavicular articulation. The clavicle is, therefore, a composite bone. This mode of development of the clavicle explains the occasional inclusion within the anatomical bone of the some of superficial descending branches of the cervical plexus, and even at times, it is said, of the cephalo-jugular vein. These structures passed in behind the precoracoid bar, between it and the primary clavicular ossification.

Costo-coracoid Ligament. - This ligament, though less distinct in man than in many of the quadrumana, is frequently well marked. It runs along the lower border of the costo-coracoid membrane, and extends from the tip of the coracoid process to the cartilage of the first rib, and thence to the sternum. As above stated, it has an interesting ancestry. It results from retrogressive changes in the inner and greater part

of the coracoid bar, and corresponds therefore to the prolonged condition of the coracoid in frogs, birds, and monotremes. It often presents a few chondral particles at or near its inner extremity.

Rhomboid or Costo-clavicular Ligament, Subclavius Muscle, Conoid and Trapezoid Ligaments, Gleno-humeral Ligament, or Ligamentum Teres of the Shoulder-joint. – All the above are derivatives of, and collectively represent, the subclavius muscle of lower animals. The rhomboid or costo-clavicular ligament represents the innermost extremity of this structure; the gleno-humeral ligament, its outermost extremity; the conoid and trapezoid ligaments, the portion immediately internal to the latter ligament; and finally, the subclavius muscle of man, its central and largest portion.

But little objection can be raised to the first part of the above statement. Being placed in a position of disadvantage in reference to action, the muscular fibres named would very naturally degenerate into a ligament.

With reference to the derivation of the conoid and trapezoid ligaments, it may be well to notice the abnormalities of the subclavius muscle in man. It may be inserted partly into the coracoid process and partly into the clavicle, or wholly into the coracoid process; it sometimes joins the fibres of the coraco-clavicular ligaments. Under these circumstances, it seems reasonable to infer that these latter ligaments result from the regression of some of the fibres of the muscle.

Seeing that the gleno-humeral ligament is closely connected with the coraco-clavicular ligaments at the base of the coracoid process, the inference with reference to the former may well be extended to the latter. This view is further supported by a most interesting case reported by Mr. Walsham in St. Bartholomew's Hospital Reports, in which the human muscle presented a partial insertion into the coracoid process, combined with a well-marked expansion into the head of the humerus.

Interclavicular Ligament. – This is a T-shaped band, which both unites the clavicles across the median line, and sends down a vertical slip to be attached to the top of the sternum. In the pectoral arch of Ornithorhyncus, the clavicles are supported at their inner extremities by a T-shaped bone of membranous origin, the interclavicle. The ligament is derived from this bony element.

Coraco-acromial Ligament, and Transverse Ligament of the Scapula. – These are representatives of bony processes which are found in sloths, and elsewhere. In the scapula of the sloth the acromion sends a long hook-like piece of bone to meet the coracoid. In many birds, also, the scapula, in the formaton of the foramen triosseum, joins the coracoid above as well as below. In the fœtus of many mammals a tract of cartilage may be detected in the situation named.

The supra-scapular foramen is entirely osseous also in the young ant-eater; its upper boundary is here formed partly by a prolongation from the body of the scapula, and partly by a prolongation from the coracoid process, – an interesting example, in the limbs, of the passage of a nerve between two centres of ossification which is so constant in the skull. The occasional ossification of the transverse ligament in man is to be viewed as a reversion to a former condition.

Views such as those above presented (See also the remarks on the round ligament of the hip-joint at the bottom of page 108d) set one dreaming. A fanciful or allegorical trilogy will be pardoned. The authoritative speaker is no less than Mr. Sutton himself, whose remarks, headed "J. B. S.," which run down the left side

of the page, are in part quoted, and in part slightly paraphrased, from the Introduction to "Ligaments; their Nature and Morphology." The Author but points to the more moderate conclusion of the Jester. A little banter may convince some better than solid argument:—

——— *J. B. S.*—"As Mother Earth devours the dust alike of Kings, philosophers, and peasants, so our nature"——

——— *Dreamer.*—"With scalpel and forceps we have turned down the flaps of our own poor skin, and are plunging our self-slimed fingers in our writhing muscles beneath!"

"buries"

"in the midst of our own gore which we are handling,"

"structures of historical rank!"

. . . "But this is the life comedy of our very entrails, and we, . . . playing at Dr. Hyde with our inmost selves! . . . are looking on from the dress-circle, and enjoying the sport!"

"King Teres, of realms which were once within us, raises with æsthetic grace the pure nacreous train of his fair femoral bride. His aged Pectineal Father advances to embrace the courtly pair. There circle around, bending the knee, his Grace the Adductor Minimus seu Quartus returned for the royal wedding, with, behind him, his more homely Longus, Brevis, and Magnus Brethren, and knights errant—migrated muscles and divorced tendons—without number, all marshalled by the Royal Princes, Rhomboid, Subclavius, the portly Gleno-humeral, and the recently ennobled Transversus. Freshly enrolled fasciæ guard the select party, and keep away the 'common garden' people. . . . Oh, the Elysian music of Dreamland!"

"But alack! We are Mr. Jekyll again!"

——— "In the immediate neighbourhood of this single band of fibrous tissue (the Ligamentum Teres), around which centre problems of such transcendental morphological interest, *there abound structures of* FUNCTIONAL VALUE, BUT OF NO INTEREST TO THE MORPHOLOGIST!"

——— *Jester.*—"Structures of FUNCTIONAL *value of* NO INTEREST *to the Morphologist!* Is that so? . . . But then, to the practical mind, Morphology is but a dazzling dream—a lovable form of fantasy, which, alas! distorts the vision and warps the judgment—a fairy tale, which blinds us to the more important facts of everyday life!"

——— "Dream on, dream on awhile, Morphology fair! Whisper sweet enchantment in our ear!"

——— "No! We will flee for our lives! We will shun thee like the deadly upas tree, or the enslaving opium pipe!"

To such as are past masters in all that can be learnt in the dissecting-room, such pure science may convey the delights of learning and culture, and may do little or no harm. But the tyro should keep clear of all such fascinating seductions.*

* *Explanatory Legend for those who are not yet read in the mysteries of Morphology*:—The Ligamentum Teres, inserted into the cartilage-surrounded pit on the head of the femur, and around

II.—SURGICAL FASCIÆ.—MR. COOKE'S VIEWS.

We have got into the habit of late of tracing the various fasciæ continuously, very much as one traces the folds of the peritoneum. And elaborate descriptions are now given of the course of fascia in front of, and behind, the several muscles, vessels, &c.

It is submitted that the practice is based upon wrong principles.

The description of the peritoneum by continuity, or by tracing its course, rests on the patent fact that the membrane is practically the same throughout. Not so with the fasciæ. These are thick, dense, and fibrous in one place, – outer side of the thigh; thin and translucent, but still dense and strong in another, – between the superficial and deep muscles of the back of the leg; thin and cellular and of little consistence in another, – between the superficial and deep muscles of the front of the forearm, and so forth.

The accepted descriptions of even the more important fasciæ, – as in the parts concerned in Inguinal and Femoral Herniæ and in the perinæum and the ischio-rectal

---

which "centre problems of such transcendental morphological interest," is the divorced tendon of the Pectineus muscle. The Gleno-humeral Ligament occupies a similar position in the upper limb: it is the divorced tendon of the subclavius muscle, of which the Rhomboid ligament is the primitive tendon of origin. There are many such remains of degenerated or migrated muscles. The principal ligaments of the body result, in fact, from the regression either of muscles or of osseous or cartilaginous structures. There is sometimes found a Fourth Adductor, or Adductor Minimus, which is usually absent, however. The Transverse Ligament of the shoulder-joint has recently been referred to its true ancestor: it is the homologue of the process of bone which connects the humeral tuberosities in the musk ox (G. Brodie). Many of the fasciæ now described are as complete myths as can well be imagined; see p. 108j. Since we have been endowed with what is now called "scientific" or "advanced" Anatomy, a correlated term has become necessary to designate the kind of Anatomy which is *not* in favour with the progressists. As a term distinctly uncomplimentary could scarcely be considered admissible, the colourless term "common garden Anatomy" (whatever this term may mean) seems to have gained pretty general acceptance. That a synonym for "Anatomy" should be needed is evidence, it is submitted, of a coming schism between practical and abstract work.

All the above tit-bits of Anatomy have a living, stirring, responsive interest for Mr. J. B. Sutton. The "little beggars"—the ossific centres and others, as they are so frequently and so *fondly* surnamed—answer playfully to the call of this master of primeval structure, and really lend an inexpressible charm to the demonstrations in advanced Anatomy at the Middlesex Hospital. For thoughtful and inquiring Anatomists, there are no more delightful entertainments than these demonstrations. All who are privileged to attend them, as the Author was for a whole winter session, must come away with the rapt belief that there is much truth in what the Master says. What differentiates Mr. Sutton's work from other similar attempts, and renders it congenial to the most conservative mind, is that it is constructive from the very first—not first destructive, and then, as far as may be convenient (and this being left to chance)—reconstructive afterwards. The edifice of human descriptive Anatomy, reared at such enormous cost in time and labour, is safe in Mr. Sutton's hands. A surgeon, as well as a scientific Anatomist—one might perhaps say, notwithstanding his eminence as a morphologist, a surgeon *first*, and a scientific anatomist *afterwards*—Mr. Sutton knows the value to medical men of Anatomy as learnt by dissections. He is one who puts practical work in the dissecting-room well to the front, and abstract science, however prominently, yet in the background, instead of reversing the order, as is the fashion now-a-days.

The Author heartily believes in "Scientific Anatomy" as taught by Mr. Sutton—that is, when everything is shown to the class. But he still thinks that even this most legitimate instruction should be given apart from the teaching of human descriptive Anatomy, and that this branch of knowledge should be the subject of *separate* examinations for the higher qualifications only.

region, – are *in a sense* incorrect and misleading. It is misleading, – misleading, that is, to one not *practically* informed, – to put it that the fascia transversalis is continued beneath Poupart's ligament to form the anterior wall of the femoral sheath; that the fascia iliaca is continued beneath the Poupart's ligament to form the posterior wall of the same sheath, &c. What, in effect, do the statements imply? They imply, if words are to have anything like a precise meaning, that the anterior wall of the femoral sheath has the same, or something like the same, structure and characters as the fascia transversalis; that the posterior wall of the femoral sheath has the same, or something like the same, structure and characters as the fascia iliaca. Anyone who has dissected the parts knows very well that this is in no way the case.

What is then the *true meaning*, and what is the *real drift*, of the above current statements? What is it which not only justifies the same, but which has made the descriptions of the Inguinal and Femoral Hernise and perinæum, as given by the great French surgeons of the beginning of the century, descriptions that will stand to the end of time, and with which the names of Velpeau, Malgaigne, Richet, and others will ever be honourably associated?

The reply is this: - *Practical considerations, and practical considerations alone.*

It is in the light of practical considerations, that the descriptions referred to must be read, if the facts are to be at all correctly understood.

Hernia breaks forth along the course of the spermatic cord, – or just to the inner side of the large vessels of the thigh. Why is this? Urine extravasated through rupture of the membranous portion of the urethra infiltrates the scrotum, and then the superficial fascia of the abdomen, but does not pass down to the front of the thigh. Why is this? Why does a hernial protrusion sometimes show itself at or near the umbilicus, or at the obturator foramen, or above the crest of the ilium between the external oblique and latissimus dorsi muscles?

Surgical anatomy was created, mainly by the surgeons above named, with a view to answering such questions; and, taking things all round, surgical anatomy has admirably fulfilled the practical purposes aimed at.

But why, the reader may ask, was not simple and plain language used that everyone could understand? Why did not the surgeons who made surgical anatomy write in such a way that even the most dull-minded could not misapprehend their meaning? The reply is that language alone, and apart from such practical work as may interpret its meaning, is inadequate to convey the precise information desired to be conveyed. There are things that cannot be made plain by mere words. It is practical work – *i.e.*, dissecting – that can alone give the key to the true meaning of the statements made in surgical anatomy, or indeed in any kind of anatomy, or indeed in any applied or practical science whatever.

Opposite the weak points of the abdominal wall, in the perinæal septum, &c., there are minor processes of fascia *sufficiently continuous* with the more extensive and more marked fasciæ transversalis, iliaca, &c., – that is to say, which maintain in prolongation of the above, and for short distances, or over small areas, *sufficiently uniform characters*, – to give, at the points named, and within narrow limits, a certain direction to intestine, urine, or pus. *For the convenience of description*, it has been considered allowable and expedient to stretch the *correct* statement to the point of extending to such minor process the original designation of the larger and more extensive fasciæ, of which they are thus taken to form a part. It is in this sense, and in this sense only, that we can say that the fasciæ transversalis and iliaca pass beneath Poupart's

ligament to form the anterior and posterior walls of the femoral sheath. Such statements are *clinical*, or at most anatomico-clinical, not simply and purely anatomical.

As above explained, current statements in reference to the more particularly surgical regions are correct, or at least fairly correct. Taken in any other sense they are incorrect, and one might almost say absurd.

Beyond such limits as are above defined, the description of fasciæ *by continuity* is, it is submitted, wrong in principle, incorrect, and misleading.

The only absolutely correct basis of description of the several fasciæ in particular is one which should elicit and explain their *structural* and *physical* characters, as observable in the several regions of the body. It is only within narrow limits that such descriptions are possible.

The fascia covering the body generally, or deep fascia, is, where exposed to pressure and friction, relatively thick and dense. Where pressure and friction are greatest, the condition is most marked – fascia lata on outer side of thigh. Where pressure and friction are less, the reverse condition presents – fascia on inner side of thigh; – strength and density increasing, however, pari passu with pressure and friction, as one approaches the knee, and still further so as one passes to the inner side of the leg, where the fascia does not differ very greatly from that on the outer side. What applies to the lower limb applies also to the upper limb, to the front and back of the trunk, to the front and back of the neck. All careful dissectors are aware of the great density of the fascia over the trapezius at its insertion into the superior curved line of the occipital bone.

The same applies to the deeper or intermuscular layers of fascia. As above stated, there is a strong, tough, though relatively thin and translucent layer of fascia between the superficial and deep muscles of the back of the leg. Why is this layer of fascia so much stronger than the corresponding layer of fascia in the upper limb, – that is than the layer of fascia between the superficial and deep muscles of the front of the forearm? Because, in the lower limb, there is an independent action of the superficial muscles to which there is nothing to correspond in the upper limb. In walking, standing on tip toe, &c., we contract the superficial muscles of the back of the leg irrespectively, or nearly so, of the deep muscles. There is no frequent action of the upper limb, in which we similarly use, – that is, use alone and forcibly, – the superficial muscles of the front of the forearm.

In the neck, again, the same thing is found. Beneath the middle part of the sterno-mastoid there is a strong layer of fascia, tough, laminated, somewhat translucent, smooth and even (through its being tensed by the omo-hyoids), – very similar in character to the fascia beneath the gastrocnemius and soleus. Both higher up and lower down the fascia becomes less distinctly laminated and more fatty, – the reason being that superiorly the sterno-mastoid rests upon a thick pad of muscles, complexus, splenius, levator anguli scapulæ, &c., while, inferiorly, on the other hand, it is drawn away from subjacent structures by its attachment to the clavicle.

Again, in the abdomen, the fascia transversalis is thickest at the lower part of the anterior wall of the abdomen, because it is there that the weight and lateral pressure of the superjacent viscera is greatest; and the fascia iliaca is thicker than the fascia transversalis on account of the iliacus muscle forming a nearly horizontal plane bearing

the full weight of the superjacent viscera, while the fascia transversalis bears little more than the side pressure of the same.

Fascia is everywhere fashioned by local mechanical conditions. If the reader doubts this, let him verify two anatomical facts. Let him examine the strong layer of fascia that covers the superficial muscles of the perinæum in the fœtus, – just where the heels have pressed more and more month by month through the cramped position enforced within the uterus. And let him contrast the thick aponeurotic layer that covers the anterior part of the gluteus medius with the thin and insignificant layer of connective tissue that covers the posterior part of the same muscle: – the anterior part of the gluteus medius is uncovered by muscle, and receives the full outside pressure; the posterior part of the muscle is covered by the gluteus maximus, and protected.

It is submitted that the views above set forth present the necessary counterpart of the morphological views of Mr. Sutton, but without clashing with the same. It is submitted that Mr. Sutton's interesting generalisations present but part of the truth, the other part being practically as above.

In connection with the above, and as an example of what Anatomy should *not* be, the Author ventures to give here, – condemning almost every word of the same, – an abstract of new views on the cervical fascia now extensively circulated:—

"The deep cervical fascia may be studied above the hyoid bone, and below it. It is of greatest importance in the latter situation.

Above the Hyoid Bone. – Two chief layers may here be recognised, the superficial and the deep. The *superficial layer*, traced upwards from the hyoid bone, encloses the sub maxillary gland, passing over the mylo-hyoid; gives off the masseteric and parotid fasciæ; and becomes attached to the lower border of the zygoma. The *deep layer* forms the stylo-maxillary ligament.

Below the Hyoid Bone. – Four layers may here be recognised, – superficial or sub-cutaneous, sterno-clavicular, tracheal, and prevertebral; these layers should be traced both horizontally, and from above downwards.

TRACING THE FOUR LAYERS HORIZONTALLY. – [1] The *Superficial or sub-cutaneous layer* starts from the ligamentum nuchæ, surrounds the trapezius, and forms the roof of the posterior triangle (where it is perforated by the external jugular vein and by the superficial branches of the cervical plexus). It then encloses the sterno-mastoid, passes over the anterior triangle of the neck, and meets its fellow in the middle line. This layer is thin behind, but thick in front, where it is joined to the sterno-clavicular layer. The anterior jugular veins lie behind the thickened conjoined layers above referred to. [2] The *Sterno-clavicular layer* is most marked below. In the middle line it meets its fellow, and blends, as above stated, with the superficial or sub-cutaneous layer. Passing outwards, it surrounds the depressors of the hyoid bone, and, at the posterior border of the sterno-mastoid, blends with the superficial or sub-cutaneous layer. [3] The *Tracheal layer* lies under the depressors of the hyoid bone, covers the trachea, and surrounds the thyroid gland. Further outwards it forms the carotid sheath. Further outwards still, over the scalenus anticus, it blends with the prevertebral fascia, and is joined both to the sterno-clavicular layer and to the superficial or sub-cutaneous layer. [4] The *Prevertebral layer* covers the longus colli and the rectus capitis anticus major. Laterally it becomes continuous with the three superficial layers.

The four foregoing layers should now be traced vertically DOWNWARDS with special reference to their relations in two situations, namely, at the top of the sternum and opposite the clavicle.

(A) AT THE TOP OF THE STERNUM. – [1] The *Superficial layer* passes over that bone. [2] The *Sterno-clavicular layer* descends in front of the depressors of the hyoid bone, and divides into two layers

which descend one behind the sternum, the other in front of that bone, the latter layer blending with the sub-cutaneous layer. Between these layers is some fat and a small lymphatic gland. [3] The *Tracheal layer* passes down into the thorax (middle mediastinum) encasing the left innominate vein. Inferiorly it blends with the pericardium. [4] The *Prevertebral layer* passes down behind the œsophagus to be lost in the loose cellular tissue of the posterior mediastinum.

(B) Opposite the Clavicle. – Only the two more superficial of the four layers of fascia above mentioned are prolonged so far outwards as this. [1] The *Superficial layer* passes over the clavicle. [2] The *Sterno-clavicular layer* passes behind the clavicle, blending with the sheath of the subclavius, and gives a covering to the subclavian vein."

If there is any truth in the general principles above submitted, the above description, and all such, founded as they are on a superficial examination of frozen sections, must be considered as pure imaginings in a line of thought which has cleaved to mere appearances and specious fictions, and has divorced itself from patent fact. In a frozen section, fat and fascia are of the same consistence, and look very much alike. But only thaw the part, and see the difference. Or, better still, simply dissect it, and leave the freezing and section-cutting alone; and then see what becomes of all the cellular layers, that look so beautiful in plaster of Paris and on paper!

The greatest evil, however, of such work as is now being pushed to the front is that the attention is thereby riveted to the page of the book and turned away from the page of Nature. Now-a-days it's all the book, the book, the book. Bookism is as a very ogre grawing out the brains of our young men. These have now so much reading to do, that they have no time to think!

> "The sub-pubic fascia (deep layer of the triangular ligament) . . . , *whose appearance and attachments can be made to vary by the scalpel of the dissector according to his preconceived notions*," . . . (Macalister).

The above admission of a great Anatomist, the fact of having dissected perinæa and Inguinal and Femoral herniæ almost without number,* and the strength, to his mind, of the views above set forth, must be the Author's apology for questioning the accuracy of recent descriptions of the perinæum, &c., and the value of the methods or modes of statement upon which such descriptions are based.

The Author owns himself to be entirely out of harmony with any attempt to merely explain, and to get men, as the phrase goes, to understand Anatomy, without their

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* This is possible in Paris. In Paris, "subjects" are buried promiscuously in accordance to their state of decomposition. The inspector makes his round once a week, and orders the removal of such "parts" as are green and odorous. These are thrown into a tub in the middle of the dissecting room, previous to burial. When a student, the Author would make "his round" a little before the inspector, and mark out in his mind what "parts," – should they be thrown into the tub, – would, – if successfully rescued, – suit his purpose. After the official tour was over, he would then make his round again, fish out, unobserved, the tit-bits from the tub, lop off the green and smelling outside, and reinstate the remnant, henceforth his property, on the dissecting room table. The authorities encouraged the little escapade rather than otherwise, and so regular and accepted did the practice become, that the then studious youth was, if he remembers rightly, not infrequently consulted as to whether a "part" should, for his service, be thrown into the tub or not! This was in the "fifties" and "sixties." Whether the same thing could be done now, the Author could scarcely say. But he would here gratefully put on record the fact that, for any special and useful purpose, the Paris authorities would always give "subjects" wholesale, and free of charge. The Author received many such for the purpose of his "Thesis on Operative Anatomy."

seeing things. Hopeless confusion, he submits, must follow all such abstract descriptions, as compared with the delightfully lucid conceptions which result from seeing.

It is on this ground that the Author ventures to disagree with the description of a "perinæal ledge." He unhesitatingly asserts that there is no such structure in the human perinæum.

Further, to make the obturator fascia continuous with the deep layer of the deep perinæal fascia or triangular ligament, when the rami of the pubes and ischia intervene between them, is, to the Author's mind, like reverting to the old description of the origins of the flexor and extensor carpi ulnares from a common layer of fascia at the back of the forearm, when one muscle is one on side of the ulna, and the other muscle on the other side.

There are properly no two layers to the superficial fascia of the perinæum, as there are in the regions of the Inguinal and Femoral herniæ. What is usually termed the "deep layer of the superficial fascia of the perinæum" binds down the superficial muscles of the perinæum, and corresponds to the deep fascia of other regions. In referring to this latter structure the double designation should be used "deep layer of the superficial fascia of the perinæum, *or* superficial perinæal fascia," just as, for the deeper structure, we use the double term "deep perinæal fascia, *or* triangular ligament." This is cumbrous, no doubt, but it is submitted that cumbrousness is the lesser of the two evils: – as matters stand, the single term "deep perinæal fascia" cannot consistently be applied alone to the "triangular ligament," and to revive the old designation "Colles fascia" in connection with the fascial covering to the superficial muscles simply conceals the difficulty, and therefore renders it the more dangerous.

ABDOMEN.

I.

PERITONEUM, &c.

110 Abdominal muscles attached to Linea alba

1. Rectus - 1/2
2. Internal O. - 2/3
3. Transversalis - 3/4

MUSCLES of the ABDOMEN.

External Oblique – Outer surface & lower borders of the *eight lower ribs*, interdigitating by four or five slips with serratus magnus & by three or four with latissimus dorsi.

By fleshy fibres into anterior half of outer lip of crest of ilium, and its aponeurosis forms in succession:

Poupart's ligament;
Gimbernat's ligament;
Outer pillar of external abdominal ring;
Inner pillar of external abdominal ring:
Superficial part of linea alba by decussating with its fellow, and perhaps also after decussating the
Triangular ligament & intercolumnar fascia of opposite side. (Vide abdominal Aponeuroses)

Internal Oblique – Outer half of Poupart's ligament; anterior two-thirds of middle lip of crest of ilium; posterior layer of lumbar fascia.

Lower border of *cartilages of four lower ribs*; linea alba; crest of pubes & pectineal line behind Gimbernat's ligament to the extent of about ½ an inch, forming part of the conjoined tendon.

Transversalis – Outer third of Poupart's ligament; anterior three-fourths of inner lip of crest of the ilium; inner surface of *cartilages of six lower ribs* interdigitating with Diaphragm; by lumbar fascia from tips of spinous processes, tips & bases of transverse processes of all the lumbar vertebræ.

Linea alba; crest of pubes & pectineal line behind Gimbernat's ligament to the extent of about ½ an inch, forming part of the conjoined tendon.

Rectus Abdominis – By two heads from crest of pubes & ligamentous fibres covering symphysis.

Cartilages of 5th, 6th & 7th ribs & side of ensiform cartilage.

This muscle is traversed by from 3 to 5 *lineæ transversæ*, irregular tendinous intersections, which interrupt the superficial fibres and adhere firmly to anterior wall of sheath; these are situated opposite umbilicus, between umbilicus & ensiform cartilage, and, frequently, one or two less complete ones, near or below umbilicus.

Pyramidalis – Front of pubes & anterior pubic ligament.

Linea alba midway between pubes & umbilicus. – Is often absent on one or both sides.

Cremaster – From middle of Poupart's ligament internally to lowest fibres of internal oblique & transversalis, and by a small pointed tendon from front of pubes & sheath of rectus, forming large external, and smaller & less constant internal bundles. Is the everted gubernaculum testis with a few additional fibres of the internal oblique, and sometimes of the transversalis, drawn or pushed down by the testicle during its descent (Curling).

Quadratus Lumborum.

ANTERIOR PORTION – Upper border of transverse processes of the two or three lower lumbar vertebræ.

Inner half of lower border of last rib.

POSTERIOR PORTION – Ilio-lumbar ligament, and for about 2 or 3 inches from posterior part of inner lip of crest of ilium.

Apices of transverse processes of the 4 upper lumbar vertebræ, and inner half of lower border of last rib,

N.—These muscles are supplied by the lower intercostal, ilio-hypogastric, & ilio-inguinal nerves. The quadratus lumborum also receives branches from the anterior divisions of the lumbar nerves.

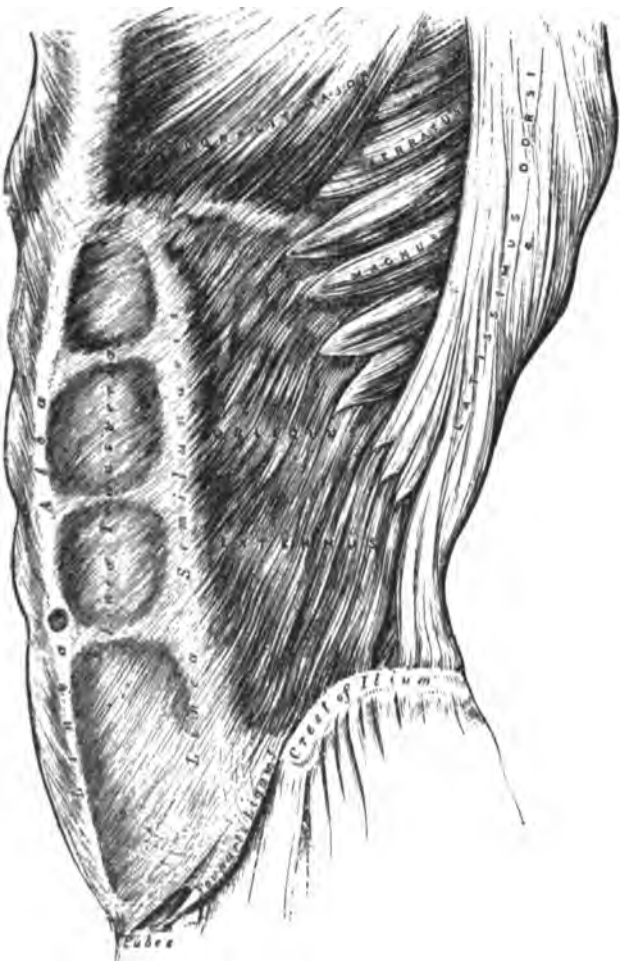


FIG. 294.—THE EXTERNAL OBLIQUE MUSCLE. (Gray.)

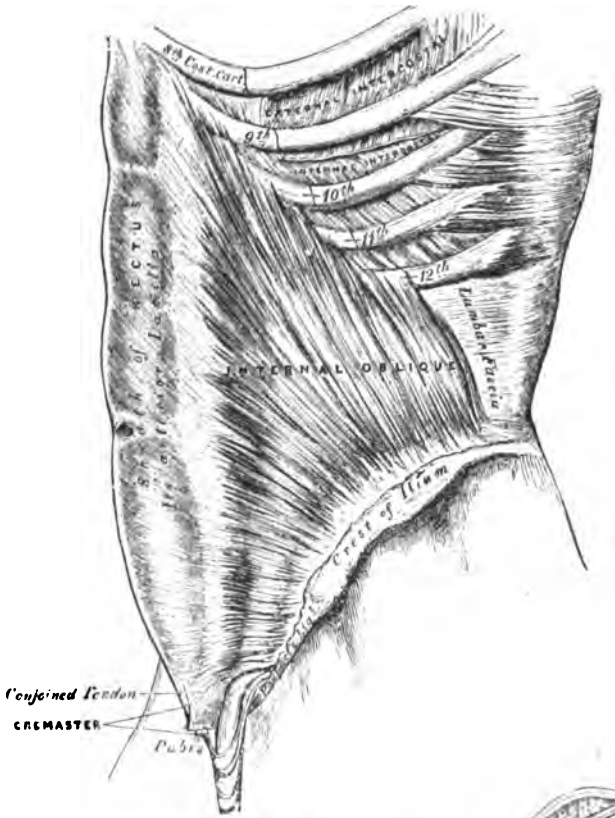


FIG. 205.—THE INTERNAL OBLIQUE MUSCLE. (Gray.)

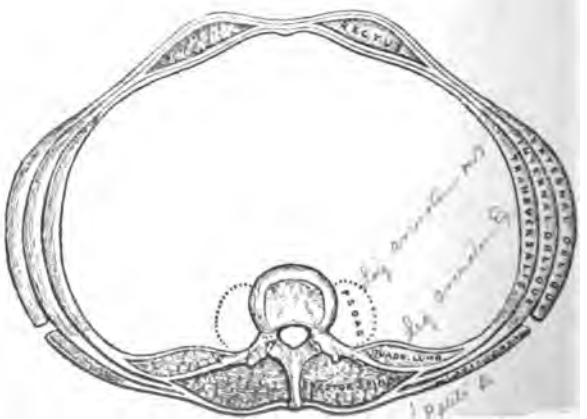


FIG. 206.—TRANSVERSE SECTION OF MUSCLES OF ABDOMEN IN LUMBAR REGION. (Gray.)

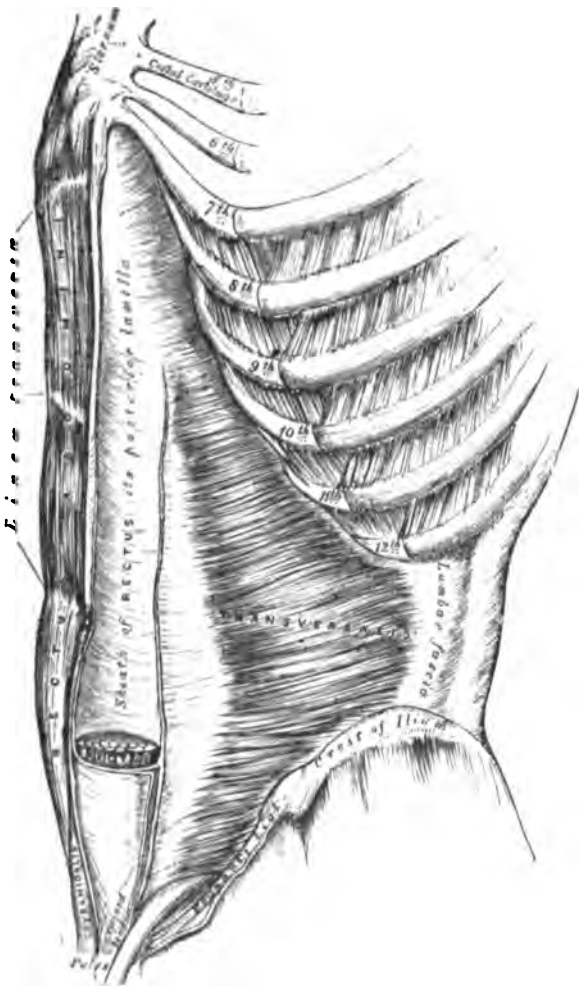


FIG. 297.—THE TRANSVERSALIS, RECTUS, AND PYRAMIDALIS MUSCLE. (Gray.)

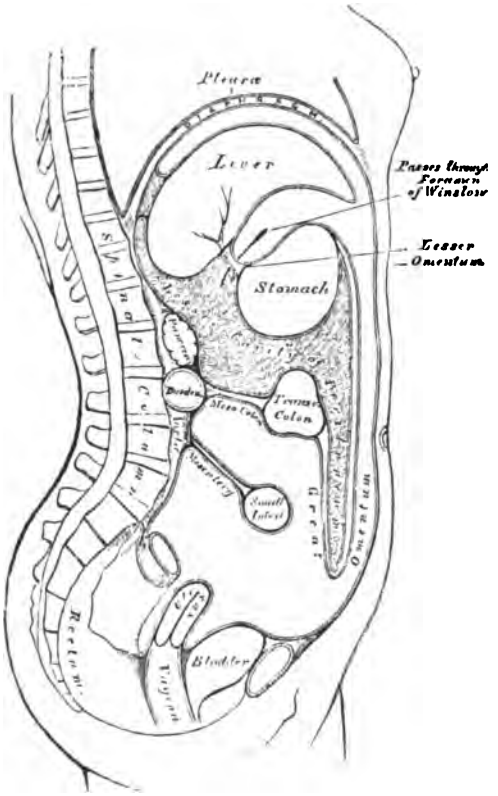


FIG. 298.—REFLECTIONS OF THE PERITONEUM AS SEEN IN A SAGITTAL SECTION OF THE ABDOMEN. (Gray.)

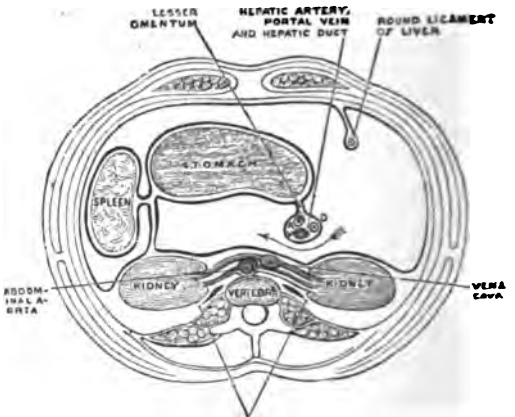


FIG. 299.—TRANSVERSE SECTION OF PERITONEUM. An arrow has been introduced into the foramen of Winslow. (Gray.)

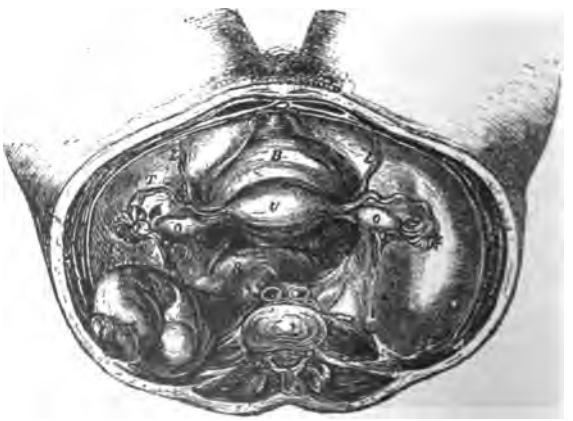


FIG. 300.—PERITONEUM OF THE FEMALE PELVIS AS SEEN FROM ABOVE. (Heath, Savage.)

R, rectum; U, uterus; B, bladder; L, round ligament; T, Fallopian tube; O, ovary.

PERITONEUM —1st Tablet.

The peritoneum is by far the most extensive & complex serous membrane of the body. To describe it completely it is necessary to trace:

1. – The two sacs separately in the vertical direction & in the middle line;
2. – The two sacs together in the vertical direction;
3. – The greater sac horizontally below the level of the umbilicus;
4. – The two sacs together horizontally above the level of the umbilicus, or through the foramen of Winslow;
5. – The ligaments formed by the peritoneum, and the omenta & mesenteries.

Along the colon & upper part of the rectum the peritoneum is thrown into numerous pendulous processes filled with adipose tissue and termed the appendices epiploicæ.

THE TWO SACS SEPARATELY.

THE GREATER SAC.

Starting from umbilicus the peritoneum passes: –

Over anterior wall of abdomen & diaphragm;
Over upper surface of liver, forming *suspensory or falciform ligament & upper layer of coronary ligament;*
Over under surface of liver to transverse fissure;
To lesser curvature of stomach & first portion of duodenum, forming *anterior layer of lesser or gastro-hepatic omentum.*
Over anterior surface of stomach;
Downwards in front of intestine, forming *anterior layer of great omentum;*
Upwards to transverse colon, forming *posterior layer of great omentum;*
Over under surface of transverse colon;
To spine, forming *inferior layer of transverse meso-colon* & covering under surface of transverse portion of duodenum;

(In the fœtus, also occasionally in the child, and even, though very rarely in the adult, the layer of peritoneum which continues the posterior layer of the great omentum ascends in front of the transverse colon without adhering to it, or adhering to it but slightly, and then passes backwards to the spine *above the transverse meso-colon.* The transverse meso-colon is then formed by the peritoneum *again passing forwards from the spine to the transverse colon,* surrounding the latter, *and for the second time passing backwards to the spine.* The pouch between the transverse meso-colon & the posterior layer of the great omentum subsequently disappears by degrees, adhesions amounting finally to complete fusion of the two layers into one, being established between the two walls of the pouch before adult age is reached).

Along superior mesenteric artery, round small intestine and back to spine, forming *mesentery;*
Downwards in front of spine & Aorta;
Over upper part of rectum, forming *meso-rectum;*
Forwards:

In Male: – To bladder, forming *posterior false ligaments of bladder & recto-vesical pouch;*
In Female: – To vagina & uterus, forming *posterior ligaments of uterus & recto-vaginal pouch;* and then over uterus & from uterus to bladder, forming *anterior ligaments of uterus & utero-vesical pouch;*

Over bladder and from bladder to anterior wall of abdomen;
Up to umbilicus, covering urachus & obliterated hypogastric arteries.

THE LESSER SAC, or SAC of the OMENTUM.

Begins at the foramen of Winslow.

Foramen of Winslow – Is a constriction of the peritoneum bounded by:
In Front – Lesser omentum containing first part of duodenum, hepatic artery, bile duct & portal vein;
Behind – Right crus of diaphragm & inferior vena cava;
Above – Lobus Spigelii of liver (or rather lobus caudatus);
Below – Hepatic artery as it passes forwards from Aorta.

From this point the peritoneum passes: –

Downwards to lesser curvature of stomach, forming *posterior layer of lesser or gastro-hepatic omentum.*
Over posterior surface of stomach;
Downwards in front of intestine and then upwards, forming the *two internal layers of great omentum;*
Over upper surface of transverse colon;
To spine, forming *upper layer of transverse meso-colon;*
Over pancreas;
To under surface of liver, forming *inferior layer of coronary ligament,* and over poster[ior] part of under surface of liver to foramen of Win[slow]

PERITONEUM.—2nd Tablet.

The two Sacs traced together in Vertical Direction.

From transverse fissure of liver: –
To lesser curvature of stomach, forming *lesser or gastro-hepatic omentum;*
Separate to surround stomach;
Descend in front of intestine, forming the *two anterior layers of great omentum;*
Ascend to transverse colon, forming the *two posterior layers of great omentum;*
Separate to surround transverse colon;
Backwards to spine, forming *transverse meso-colon;*
Separate:
One descends and forms in succession the mesentery, meso-rectum, recto-vesical pouch (or recto-vaginal & utero-vesical pouches), etc.
The other ascends in front of pancreas and passes over back part of under surface of liver to foramen of Winslow.

(In the fœtus, also occasionally in the child, and even, though very rarely, in the adult, the two posterior layers of the great omentum ascend in front of the transverse colon without adhering to it, or adhering to it but slightly, and then pass backwards together to the spine *above the transverse meso-colon.* Here they separate: – One layer descends, and forms in succession *the transverse meso-colon*, the mesentery, meso-rectum, &c.; the other layer ascends, as above stated, over the pancreas & liver. The pouch between the transverse meso-colon & the great omentum subsequently disappears by degrees, adhesions amounting finally to complete fusion of the two layers into one, being established between the two walls of the pouch before adult age is reached.

Greater Sac traced Horizontally below Level of Umbilicus.

From median line of anterior wall of abdomen: –
To right iliac fossa, where it forms *meso-cæcum* & lower part of *ascending meso-colon;*
Along lateral & posterior walls of abdomen to spine, where it meets superior mesenteric vessels and forms mesentery;
To left iliac fossa, where it forms *sigmoid meso-colon;*
Along lateral & anterior walls of abdomen to median line.

The two sacs traced together Horizontally above Level of Umbilicus or through Foramen of Winslow.

From median line of anterior wall of abdomen: –
Over anterior & lateral walls of abdomen & over right kidney;
Through foramen of Winslow;
Over front of pancreas;
To spleen & then to back of stomach, forming *posterior layer of gastro-splenic omentum;*
Over posterior surface of stomach;
Back to foramen of Winslow, forming *posterior layer of lesser or gastro-hepatic omentum;*
Reflected outwards in front of bile duct, hepatic artery & portal vein, forming *anterior layer of lesser or gastro-hepatic omentum.*
Over front of stomach;
Round spleen & to under surface of diaphragm, forming *anterior layer of gastro-splenic omentum & suspensory ligament of spleen.*
Over left kidney;
Over lateral & anterior walls of abdomen to median line.

PERITONEUM.—3rd Tablet.

LIGAMENTS — Reflexions of peritoneum from walls of the abdomen or pelvis to viscera which are not portions of the intestinal canal.

Belong to liver, bladder, uterus, & spleen.

Ligaments of the Liver - Four:

SUSPENSORY OR FALCIFORM LIGAMENT - Triangular or sickle-shaped fold reflected over obliterated umbilical vein or round ligament, and attached to upper surface of liver, diaphragm, & sheath of rectus.

CORONARY LIGAMENT - Consists of two layers separated by a considerable interspace, in which interspace the posterior border of the liver is connected to the diaphragm by firm areolar tissue. Its superior layer & the right half of its inferior layer are formed by greater bag; the left half of its inferior layer is formed by lesser bag.

LATERAL LIGAMENTS - The two triangular & pointed extremities of coronary ligament. The left one is the longest & most distinct.

Ligaments of the Bladder - Five in number, and termed false ligaments:

POST. FALSE LIGAMENTS - The margins of recto-vesical pouch, in the male, of utero-vesical pouch, in the female. Contain obliterated hypogastric arteries & ureters.

LATERAL FALSE LIGAMENTS - From sides of bladder to sides of pelvis.

SUP. FALSE LIGAMENT - Over urachus and obliterated hypogastric arteries to umbilicus.

Ligaments of the Uterus - Six:

BROAD LIGAMENTS - From sides of uterus to sides of pelvis. Their free margin contains from before backwards round ligament, Fallopian tube, & ovary.

ANT. & POST. LIGAMENTS - The margins of utero-vesical & recto-vaginal pouches. Obliterated hypogastric arteries & ureters are contained in both these folds.

Suspensory Ligament of the Spleen - Connects upper end of spleen to diaphragm.

OMENTA — Folds proceeding from the stomach to other viscera. Three:

Lesser or Gastro-hepatic Omentum - From transverse fissure of liver to lesser curvature of stomach. - Its right free border contains hepatic artery, bile duct & portal vein, and forms anterior boundary of foramen of Winslow.

Great or Gastro-colic Omentum - Consists of four layers, of which the most anterior & the most posterior belong to greater bag, and the two internal to lesser bag. The two anterior layers descend from great curvature of stomach & spleen; the two posterior ascend to transverse colon (at least in adult; for arrangement in fœtus see foregoing Tablets).

Gastro-splenic Omentum - Connects hilum of spleen to great cul de sac of stomach. Contains splenic vessels & vasa brevia, and is continuous inferiorly with great omentum.

MESENTERIES — Folds connecting greater part of intestine to posterior wall of abdomen. Seven:

Mesentery Proper - Its root extends from left side of 2nd lumbar vertebra to right sacro-iliac synchondrosis. Its free border contains the small intestine. It is continuous superiorly with inferior layer of transverse meso-colon, inferiorly with meso-cæcum & ascending meso-colon.

Meso-cæcum - Usually peritoneum merely passes in front of cæcum; and also merely in front of ascending colon, forming the

Ascending Meso-colon.

Transverse Meso-colon - Formed by junction behind transverse colon of the two ascending layers of the great omentum. Backwards from transverse colon to spine, where it meets transverse portion of duodenum, and becomes continuous with mesentery.

Descending Meso-colon - Similar to ascending meso-colon.

Sigmoid Meso-colon - Broad & well marked fold, which allows of considerable mobility on the part of sigmoid flexure.

Meso-rectum - Surrounds almost completely first portion of rectum, and covers second portion in front & at sides above, in front only towards middle, not at all below.

SUPERIOR MESENTERIC ARTERY.

From front of aorta just below cœliac axis and behind splenic vein & pancreas.
Forwards between pancreas & transverse portion of duodenum, and crosses front of the latter.
Curves downwards to the right between layers of mesentery to right iliac fossa, and inosculates with its own ileo-colic branch.

BRANCHES:

Inferior Pancreatico-duodenal – Given off behind pancreas.
Ascends along concave border of duodenum and joins with superior pancreatico-duodenal.

Vasa intestini tenuis – Ten or twelve or more, and arise from convex side of art.
Descend between layers of mesentery and divide each of them into two branches, by junction of each of which with the neighbouring branch, a first series of arches is formed, to which 2nd, 3rd, 4th, & even 5th rapidly diminishing tiers succeed, the terminal branches encircling the intestine and ramifying in its coats.

Ileo-colic – The lowest branch from concavity.
Between layers of mesentery towards ileo-colic valve, and divides into:
ASCENDING BRANCH – To beginning of colon, and inosculates with colica dextra.
DESCENDING BRANCH – To end of ileum, and inosculates with termination of superior mesenteric, both branches forming arches as above.

Colica dextra – From middle of concavity.
Beneath peritoneum and in front of right kidney to middle of ascending colon, and divides into
ASCENDING & DESCENDING BRANCHES, – Which inosculate respectively with the colica media & the ileo-colic, also forming arches as above.

Colica media – From upper part of concavity.
Between layers of transverse meso-colon towards middle of transverse colon, dividing as preceding arteries, and similarly inosculating with colica dextra & colica sinistra.

INFERIOR MESENTERIC ARTERY.

From left side of aorta one or two inches above bifurcation.
Descends along left side of aorta and front of psoas towards left iliac fossa, and then, under the name of superior hæmorrhoidal, curves to the right in front of left common iliac & ureter, and descends into the pelvis behind rectum, between layers of meso-rectum.

BRANCHES:

Colica sinistra – Beneath peritoneum and in front of left kidney to middle of descending colon, and divides into
ASCENDING & DESCENDING BRANCHES, – Which inosculate respectively with the colica media and the sigmoid artery, and supply intestine as above described.

Sigmoid Artery – Across psoas to sigmoid flexure of colon, and divides into two branches, which inosculate with colica sinistra and sup. hæmorrhoidal.

Superior hæmorrhoidal – The continuation of the inferior mesenteric.
Follows course above described, and divides opposite middle of sacrum into two branches, which descend on each side of rectum to near its lower end, and join with middle hæmorrhoidal.

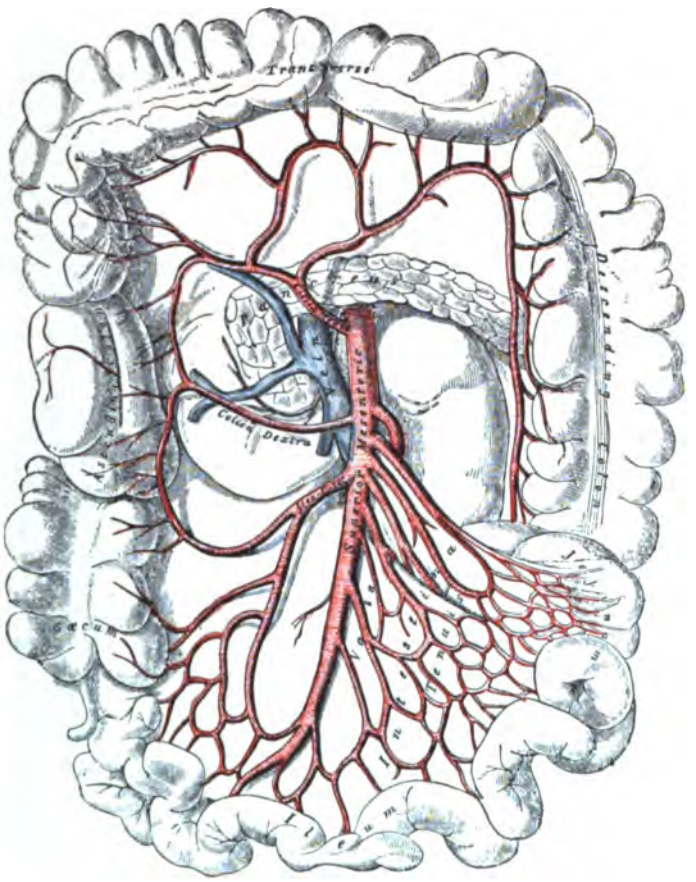


FIG. 301.—THE SUPERIOR MESENTERIC ARTERY AND ITS BRANCHES. (Gray.)

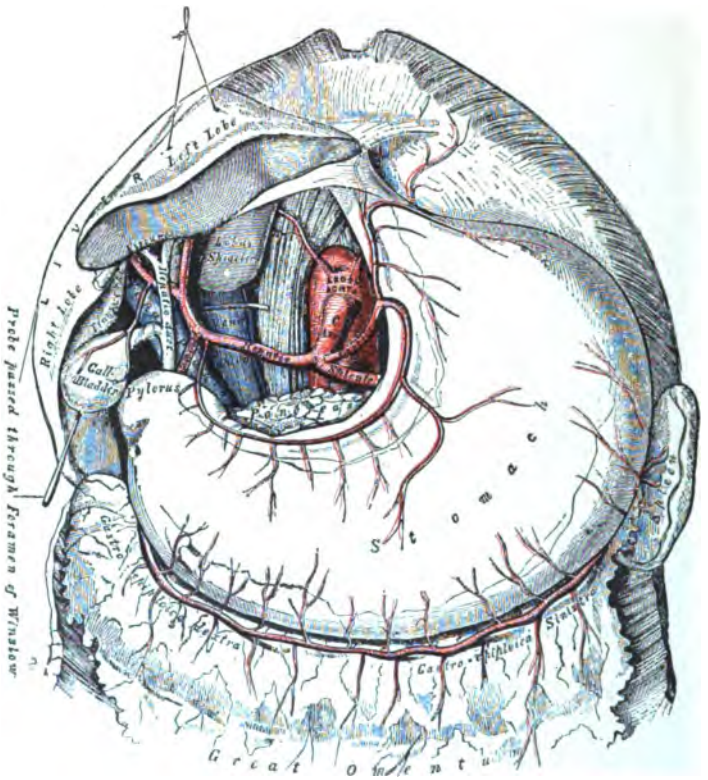


FIG. 302.—THE CŒLIAC AXIS AND ITS BRANCHES. (Gray.)

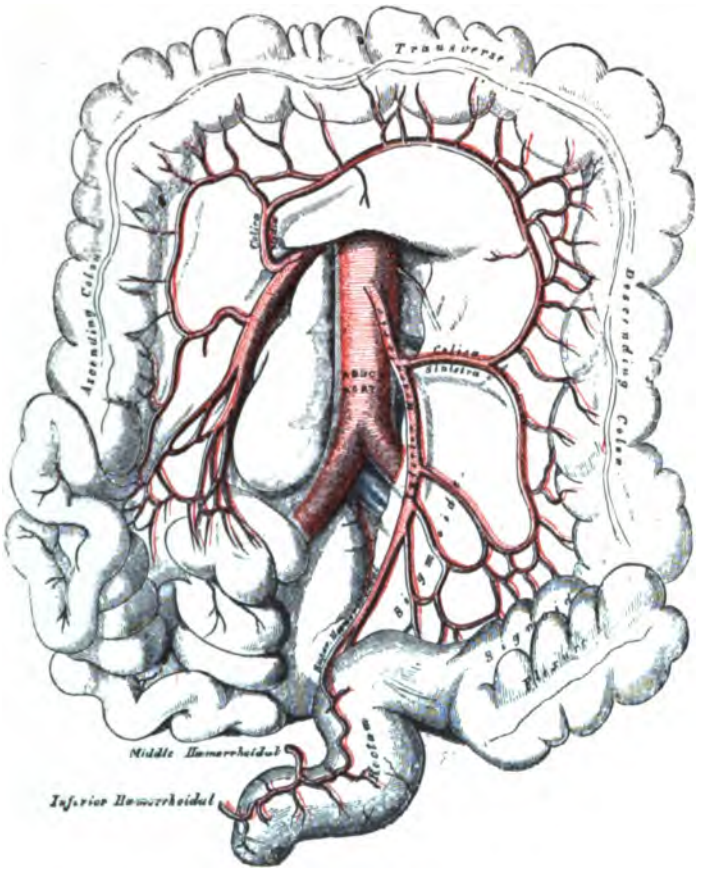


FIG. 303.—THE INFERIOR MESENTERIC ARTERY AND ITS BRANCHES. (Gray.)

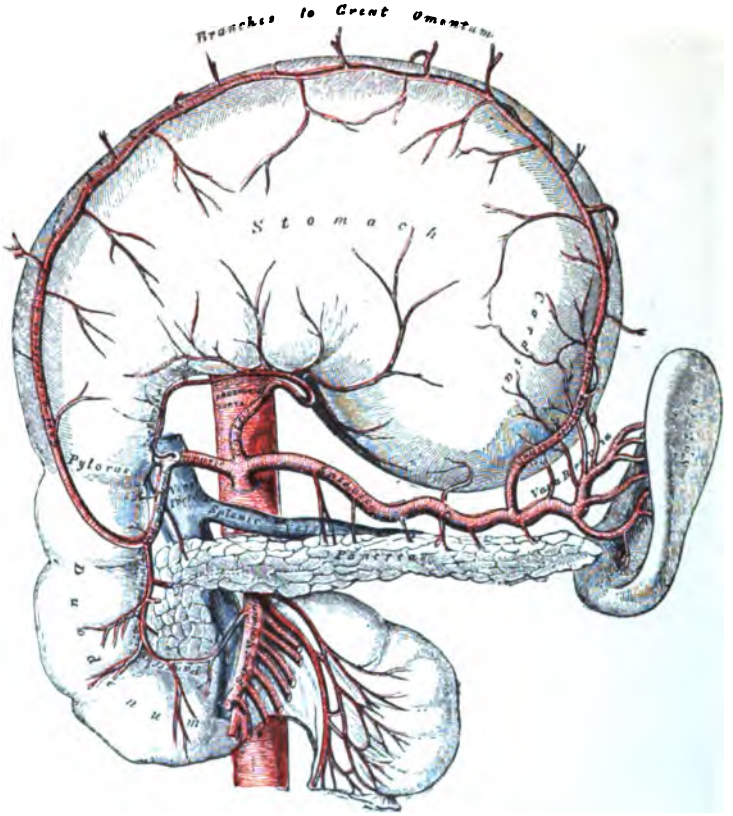


FIG. 301.—THE COELIAC AXIS AND ITS BRANCHES, THE STOMACH HAVING BEEN RAISED. (Gray.)

CŒLIAC AXIS.

Short thick trunk, from front of aorta between pillars of diaphragm.

Forwards above pancreas and between lobus Spigelii & right semilunar ganglion on the right, and left semilunar ganglion & cardiac end of stomach on the left, for about half an inch, and divides into:

GASTRIC, OR CORONARIA VENTRICULI – The smallest.

Upwards and to the left to cardiac orifice of stomach.

Along lesser curvature between layers of lesser or gastro-hepatic omentum to pylorus, where inosculates with pyloric branch of hepatic; gives branches to both surfaces of stomach.

HEPATIC – Intermediate in size in the adult; the largest in the fœtus.

Upwards and to the right in front of foramen of Winslow, between the two layers and along right border of lesser or gastro-hepatic omentum, – ductus communis choledochus lying to the right, and the vena portæ behind, – and divides in transverse fissure of liver into two branches, which accompany divisions of vena portæ & hepatic duct to right & left lobes. Gives off branches:

Pyloric – To pylorus, and along lesser curvature, inosculating with gastric.

Gastro-duodenalis – Large; downwards behind duodenum, and divides into:

GASTRO-EPIPLOICA DEXTRA – Along greater curvature of stomach between layers of great omentum, giving branches to both surfaces of stomach and to omentum, and inosculates with gastro-epiploica sinistra.

PANCREATICO-DUODENALIS SUPERIOR – Descends between pancreas and duodenum and anastomoses with inferior pancreatico-duodenalis, a branch of superior mesenteric.

Cystic – Arises from right division. – Upwards to neck of gall bladder, and ramifies on its under surface, and between it & liver.

SPLENIC – The largest.

Tortuous course to the left behind upper border of pancreas and above splenic vein, and divides into numerous branches which enter hilum of spleen. – Gives off:

Pancreaticæ parvæ – Numerous, small.

Pancreatica magna – From left to right along posterior surface of pancreas.

Vasa brevia – From five to seven in number; between layers of gastro-splenic omentum to splenic end of stomach.

Gastro-epiploica sinistra – Along greater curvature of stomach between layers of great omentum, giving branches to both surfaces of stomach & to omentum, and inosculating with gastro-epiploica dextra.

THE STOMACH.

Is situated in the left hypochondriac, epigastric, & part of right hypochondriac regions, and presents

Ant. Surface – Looks upwards & forwards, and is in contact with under surface of liver, diaphragm, and anterior wall of abdomen opposite *pit of stomach*.

Post. Surface – Directed downwards & backwards, and covered with peritoneum of lesser sac, by which sac it is separated from pancreas, great vessels of abdomen, crura of diaphragm & solar plexus. Rests upon transverse meso-colon.

Great or Splenic End, Great Cul-de-sac or Fundus – Lies beneath the six lower left ribs, in contact with the spleen to which it is connected by the gastro-splenic omentum

Lesser or Pyloric End – In contact with anterior wall of abdomen, under surface of liver, & neck of gall-bladder

Greater Curvature – Lies above transverse colon, and gives attachment to great omentum.

Lesser Curvature – Connected to transverse fissure of liver by lesser or gastro-hepatic omentum, and to under surface of diaphragm by gastro-phrenic ligament.

Œsophageal or Cardiac Opening – Funnel-shaped, and situated above & behind the pyloric opening

Pyloric Opening – Guarded by pylorus, and is more movable than the œsophageal.

When the stomach is distended its greater curvature is elevated & carried forwards, while its anterior surface is turned upwards, and its posterior surface downwards

CORRECTED (?) OR "UP-TO-DATE" TABLET.

THE STOMACH.

Lies nearly vertically in the left *hypochondriac* and *epigastric** regions, its upper enlarged extremity rising some three inches above and to the left of the cardia, while its lower extremity, the pyloric opening, is close to the median plane.†

Upper Extremity, or Great Cul-de-sac - Enlarged, and projecting upwards as stated above; in contact with left cupola of diaphragm, which, with the left lobe of the liver, separates it from the heart and the left lung; partly capped by the upper and inner extremity of the spleen.

Lesser or Pyloric End - In a plane some six or seven inches inferior, but only slightly anterior to that of the fundus; presents a double bend backwards, giving an appearance of a double constriction, the distal bend, which is marked by a real constriction, corresponding to the pylorus; the intermediate bulging is the lesser cul-de-sac, or antrum pylori.

Greater Curvature - Running along the left border;

Lesser Curvature - Running along the right border, - both connected as described on opposite page.

Posterior Surface - Resting from before backwards on the following parts:—

1. Transverse colon and mesocolon, the latter continued on to the prominent anterior border of the pancreas;

2. Large concave upper surface of pancreas, the latter continued on to the

3. Upper part of the left kidney and suprarenal capsule, the surface of which latter organs are further continued on to the

4. Large inner concave surface (gastric surface) of the spleen, - the latter passing into the partial cap for the great cul-de-sac. (*See* Stomach-Chamber, p. 132u.)

Anterior Surface - In contact with diaphragm, anterior wall of abdomen, and under surface of left lobe of liver.

Œsophageal Opening - Relatively fixed; lies behind inner part of seventh left costal cartilage, opposite tenth dorsal vertebra.

Pyloric Opening - Very variable as to position and direction. (*See* pp. 132b to e.)

Other points as on opposite page. For present views as to position of stomach in varying conditions of emptiness or distention, *see* p. 132b.

The writing of other "up-to-date" Tablets has been pressed upon the Author.

He has decided, however, not to bring out such Tablets for the present, - simple reference to the Notes, in regard to all the newer matter, being considered sufficient.

It will be seen that the corrections (?) required to be embodied in such Tablets, - required according to certain views, - would consist mainly in *the substitution of the data*

* *See* foot-note, page 132c. † *See* page 132b.

obtained through the study of the "reconstructed" forms – as necessarily conducted by the special anatomist – for *those obtainable through the ordinary processes of dissection open to every student.* This would be taking the true study of anatomy – the basis on which all Medicine and Surgery rest – out of the hands of those who are to apply the science: It will be noted that *not one* of the points in which the new Tablet given above differs from the older one, can be verified by the dissector, or be learnt by him otherwise than as an abstract statement embodied at best in models and diagrams.

The question is discussed more fully, pp. 132cc to 132hh.

The Tablets as first written present to-day as correct a statement of what may be seen on the dissected body in the dissecting room, as they ever did: *Dissectional anatomy* does not change.

There can be no question, therefore, of the Tablets being corrected in the usual sense of the term. Descriptions from one point of view may be replaced by descriptions from another point of view; just as a bird's-eye view of London taken from the top of St. Paul's may be replaced in any particular frame by a bird's-eye view taken from the top of the Monument: but this is all.

The change in regard to the Tablets has not been thought necessary.

Except in the case of the stomach, where some confusion was feared, the older descriptions given in the Tablets have been left standing side by side with the newer ones given in the Notes.

The spleen as seen in the dissecting room, not unfrequently presents on its inner aspect a more or less marked vertical ridge situated just behind the hilum, which ridge demarcates the recently described renal and gastric surfaces. This is about *the only point of the new descriptions that can be verified on healthy parts in the dissecting room.* The cirrhotic and hardened liver may sometimes present a fairly distinct omental tuberosity, and perhaps a definable posterior surface with one or two of the new fossæ. But the pancreas and the kidney, as seen in dissecting room, *never present any* of the new features now attributed to them.

There is one somewhat prominent point, – the relations of the portal vein to the head of the pancreas, – as to which the new descriptions directly contradict the older ones. Say the older descriptions, The portal vein lies behind the head of the pancreas. Say the new descriptions, It lies in front. The discrepancy will be found explained, p. 132n.

The cæcum, as precisely limited to the cul-de-sac below the entrance of the small intestine, is usually covered all round by peritoneum.

The posterior attachment of the transverse mesocolon is to the prominent anterior border of the "reconstructed" pancreas. (*See* foot-note, p. 132n.) Below this, the layer of peritoneum of the greater sac which is in continuation with the inferior layer of the transverse mesocolon, covers the anterior aspect of the portion of the duodenum which projects below that fold.

THE SMALL INTESTINE. —*See Notes, pp.* 132d *to* g.

Is a slightly narrowing convoluted tube about 20 feet long, connected to the spine by the mesentery in the greatest part of its extent.

It is divided into:

DUODENUM — Vide below.

SMALL INTESTINE PROPER — Is rather arbitrarily divided, no defined limit existing, into:

JEJUNUM — The upper two fifths. Wider, thicker, & more vascular, and has its villi & valvulæ conniventes more, and its Payer's patches less, numerous & developed.

ILEUM — The lower three-fifths. Narrower, thinner, & less vascular, and has its villi & its valvulæ conniventes less, and its Payer's patches more, numerous & developed.

THE DUODENUM

Is the shortest, widest & thickest part of the small intestine, and has no mesentery. Its length is from 8 to 10 inches, or about twelve finger breadths. – Into it open by a common orifice the common bile & pancreatic ducts, and the villi & valvulæ conniventes are larger & more numerous immediately below this opening than in any other part of the small intestine. – Its course is:

Upwards & to the right to under surface of liver & neck of gall-bladder:
Downwards in front of right kidney;
Transversely to the left to left side of 2nd lumbar vertebra, where it is crossed by superior mesenteric artery, and where mesentery begins.

RELATIONS:

First, or Ascending Portion –

ABOVE – Under surface of liver & neck of gall-bladder;
BEHIND – Right border of lesser omentum, hepatic artery, bile duct, portal vein.

Second, or Descending Portion –

IN FRONT – Hepatic flexure of colon;
BEHIND – Right kidney;
ON INNER SIDE – Head of pancreas, ductus communis choledochus, pancreatico-duodenal arteries.

Third, or Transverse Portion –

IN FRONT – Descending layer of transverse meso-colon, superior mesenteric vessels.
BEHIND – Aorta, inferior vena cava, crura of diaphragm;
ABOVE – Lower border of pancreas, superior mesenteric vessels.

THE LARGE INTESTINE.—*See Notes, pp.* 132g *to* k.

About 5 feet long, sacculated. Diminishes in size till just above anus, where it is considerably enlarged.

Consists of *cæcum, ascending, transverse, & descending colon, sigmoid flexure & rectum.*

CÆCUM or CAPUT CÆCUM COLI — The cul-de-sac situated below entrance of small intestine into the large; is the most dilated part of colon.

Lies in right iliac fossa, where it is retained by the peritoneum which covers its front & sides, and sometimes surrounds it entirely in a distinct fold, the meso-cæcum.

Presents:

Appendix Vermiformis – A tubular prolongation from 2 to 6 inches long & of about the diameter of a goose-quill connected with lower & back part of cæcum; usually directed upwards & inwards behind it, and retained by a fold of peritoneum.

Ilio-Cæcal or Ilio-Colic Valve, or Valve of Bauhin – Situated at entrance of small intestine into the large at upper inner & back part of cæcum.

Formed by two crescentic folds of the mucous & submucous coats & circular muscular fibres of the gut, which folds are separated by a narrow antero-posterior aperture.

The upper fold is nearly horizontal, and is the smallest.

The lower fold is oblique, and is the largest.

At their points of coalescence they are continued upon wall of gut into two prominent folds, the *frænæ*.

Their surface turned towards the small intestine is covered with villi, the other surface has no villi, and is quite smooth.

ASCENDING COLON —

Upwards to under surface of liver on right side of gall-bladder, where it curves to the left, forming *hepatic flexure*.

Bound down against quadratus lumborum & right kidney by peritoneum which covers its front & sides, and sometimes encloses it in a distinct fold, the ascending meso-colon.

TRANSVERSE COLON or ARCH of the COLON —

Curves forwards & to the left between confines of umbilical & epigastric regions to left hypochondrium, where it bends downwards, forming *splenic flexure*. Is very movable, being comprised between the two ascending layers of great omentum, which layers join again behind it to form transverse meso-colon.

Its relations are:

Above – Liver, gall-bladder, great curvature of stomach, lower end of spleen;

In Front – Great omentum, anterior wall of abdomen;

Behind – Transverse meso-colon, 3rd portion of duodenum.

DESCENDING COLON —

Downwards in front of left crus of diaphragm, left kidney & quadratus lumborum to left iliac fossa, where it ends in sigmoid flexure. Covered by peritoneum in front & at sides, sometimes entirely surrounded by a distinct fold, the descending meso-colon.

SIGMOID FLEXURE —

Commences at crest of ilium, ascends to right or left, descends, and ends in rectum opposite left sacro-iliac synchondrosis. Freely movable, being retained by only a loose fold of peritoneum, the sigmoid meso-colon

FIG. 305.—THE CÆCUM AND COLON LAID OPEN TO SHOW THE ILEO-CÆCAL VALVE. (Gray.)

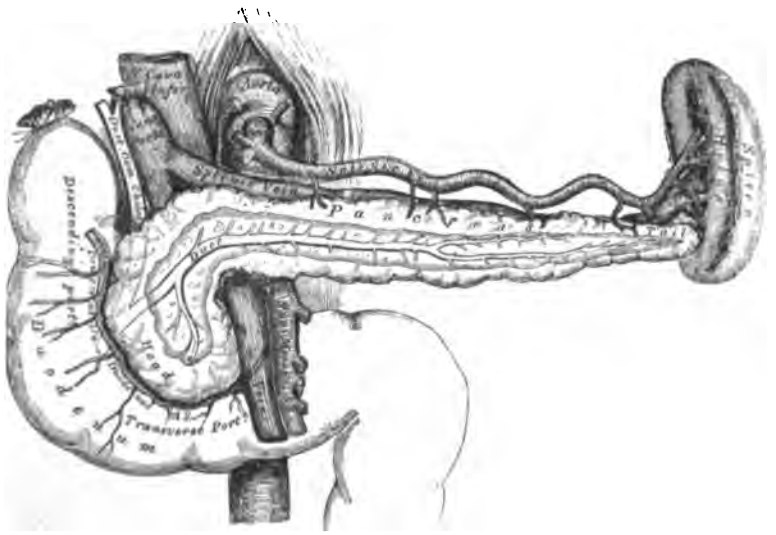


FIG. 306.—THE PANCREAS AND ITS RELATIONS. (Gray.)

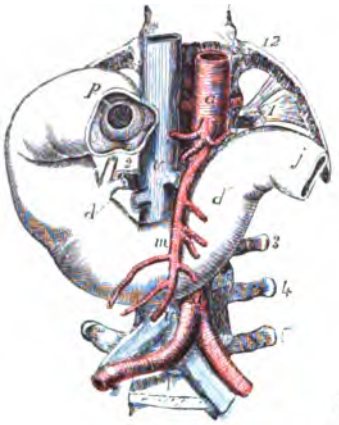


FIG. 307.—THE RELATIONS OF THE DUODENUM. (Quain.)

p, on first portion of duodneum, points to pylorus; *d*, on second portion opposite common orifice of bile & pancreatic ducts; *d'*, on fourth portion; *m*, superior mesenteric artery; *v*, vena cava; *o*, aorta. (See expl. p. 132b.)

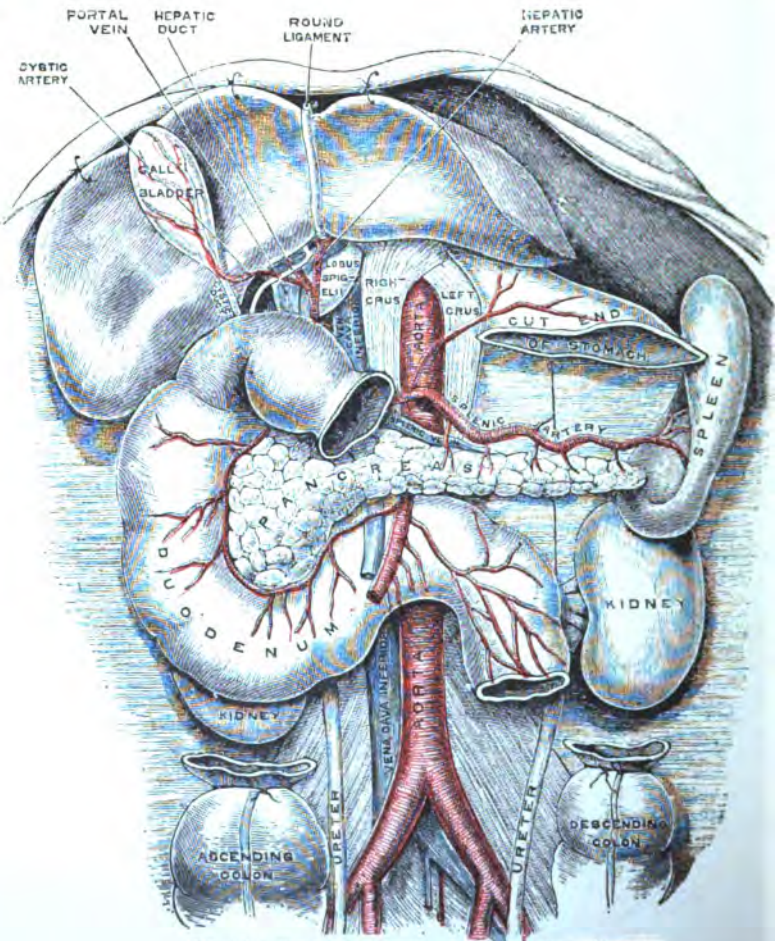


FIG. 308.—THE DEEPER VISCERA OF THE ABDOMEN. (Gray.)

THE PANCREAS.—*See Notes, pp.* 132m *and* n.

Lies behind stomach & lesser bag of peritoneum opposite first lumbar vertebra. It is long, narrow, flattened from before backwards, & of a reddish cream-colour, and presents:

Head, or Right Enlarged Extremity – Curves downwards, and is embraced by concavity of duodenum, the ductus communis choledochus & the pancreatico-duodenal arteries lying between the two organs, the former behind, the latter in front. – The lower & back part of the head (sometimes detached from the remainder of the gland, and then called the *lesser pancreas*), passes to the left behind superior mesenteric vessels, forming the posterior wall of an incomplete canal in which these vessels are enclosed.

Body, or Central Flattened Portion – Presents:

ANTERIOR SURFACE – Convex, covered by peritoneum belonging to lesser bag, & by posterior surface of stomach.

POSTERIOR SURFACE – Concave; in relation with:

Pillars of diaphragm, left quadratus lumborum, left kidney & left suprarenal capsule;

Aorta, vena cava, mesenteric vessels, commencement of vena portæ, & left renal vessels.

UPPER BORDER – Thick, corresponds to cœliac axis, and is deeply grooved for splenic artery & vein.

LOWER BORDER – Thinner, separated from transverse portion of duodenum by superior mesenteric vessels.

Lesser End, or Tail – Lies a little higher than the head, in contact with left kidney & left suprarenal capsule, & lower & back part of spleen, to which latter organ it is slightly adherent.

PANCREATIC DUCT, or CANAL OF WIRSUNG — Runs from left to right through whole length of the gland, lying in the vicinity of its anterior surface & lower border. In the head it curves downwards on left side of ductus communis choledochus. Both ducts then perforate together the muscular coat of the intestine, run side by side for about three-quarters of an inch beneath mucous membrane, and open by a common orifice situated on inner wall of descending portion of duodenum a little below its middle, about three or four inches from pylorus. The duct from the lesser pancreas opens into canal of Wirsung near its termination, or, sometimes, forms a supplementary canal which opens separately into duodenum an inch or more above canal of Wirsung.

STRUCTURE — The pancreas is a racemose or conglomerate gland and is very similar to the salivary glands, excepting that its tissue is somewhat softer & looser.

VESSELS & NERVES – *Arteries* from the splenic and superior & inferior pancreatico-duodenal. – *Veins* open into the splenic & mesenteric. – *Lymphatics* open into the lumbar glands. – *Nerves* are from solar plexus.

THE SPLEEN.—*See Notes, pp.* 132p *to* 132r.

Is compressed & oval in form, soft, brittle, & of a dark reddish-blue colour, and lies in left hypochondrium, embracing cardiac end of stomach, to which it is connected by gastro-splenic omentum. It presents:

Outer Surface – Convex, in relation with under surface of diaphragm; corresponds to 9th, 10th, & 11th ribs.

Inner Surface – Concave. Presents a little behind its middle the hilum, a vertical fissure pierced by several irregular foramina for the blood-vessels, lymphatics & nerves, and is related with:

In Front – Great cul-de-sac of stomach;
Behind – Left crus of diaphragm, left suprarenal capsule & usually a process of lesser sac of peritoneum;
Below – Tail of pancreas.

Upper Extremity – Thick, rounded, attached to diaphragm by suspensory ligament.

Lower Extremity – Pointed, in relation with splenic flexure of colon.

Anterior Border – Thin, frequently notched.

Posterior Border – Thick, rounded, lies on left kidney.

THE EXTERNAL BILE DUCTS.

Hepatic Duct – Formed in transverse fissure by junction of the two large excretory ducts from right & left lobes

Downwards & to the right between the two layers of lesser or gastro-hepatic omentum & behind first portion of duodenum, having hepatic artery on the left & vena portæ behind, and joins with cystic duct to form ductus communis choledochus. Is about an inch & a half long, and is intermediate in size between cystic duct & ductus communis choledochus.

GALL-BLADDER — Pear-shaped, three or four inches long, an inch wide at largest part; holds from 8 to 12 drachms. Obliquely directed downwards, forwards, & to the right, & lies in a fissure or fossa on under surface of liver between lobus quadratus & right lobe proper. Presents:

UNDER SURFACE – Covered by peritoneum, which in most cases merely passes over it; in relation with hepatic flexure of colon & first part of duodenum; sometimes with pyloric end of stomach. – Occasionally the peritoneum entirely surrounds the gall-bladder, which latter is then connected to the liver by a small mesentery.

UPPER SURFACE – Connected to the liver by firm areolar tissue & vessels; sometimes by a small mesentery.

ANTERIOR ENLARGED EXTREMITY, OR FUNDUS – Covered by peritoneum; touches abdominal parietes opposite tip of 10th costal cartilage.

POSTERIOR CONSTRICTED EXTREMITY, OR NECK – Forms two turns upon itself like an italic *f*, and is continued into the cystic duct.

Cystic Duct – Downwards & to the left between the two layers & along the right border of lesser or gastro-hepatic omentum and behind ascending portion of duodenum, having the cystic artery on the left & the vena portæ behind, and joins with hepatic duct to form ductus communis choledochus. Is about an inch long, and is rather narrower than the hepatic duct.

Ductus Communis Choledochus – Downwards & slightly to the left between the two layers & along the right border of lesser or gastro-hepatic omentum, having hepatic artery on the left & vena portæ behind.

Between head of pancreas & descending portion of duodenum on right side of pancreatic duct, and with pancreatico-duodenal arteries which lie slightly in front.

Perforates muscular coat of intestine in common with the latter duct. Both ducts then run together for about three-quarters of an inch between coats of intestine, and, becoming slightly constricted, open by a common & prominent orifice situated on inner wall of descending portion of duodenum a little below its middle, about three or four inches from pylorus. – The common bile duct is about three inches long.

THE LIVER. —*See Notes, pp.* 132e *and* w *to* z.

The largest gland in the body, of a dull reddish brown colour, situated in right hypochondriac, epigastric & part of left hypochondriac regions. – Its transverse & antero-posterior diameters, and its greatest thickness are usually about twelve, six, & three inches respectively. It weighs from three to four pounds. – Presents:

UPPER SURFACE — Smooth, convex, divided into right, largest, & most convex lobe, and left lobe, smaller & flatter, by suspensory or falciform ligament. In relation with under surface of diaphragm, & the six or seven lower ribs, and to a slight extent in the upright posture & during deep inspirations, especially in women & children, with anterior wall of abdomen.

UNDER SURFACE — Vide next Tablet.

ANTERIOR BORDER — Thin, inclined downwards & to the right, notched deeply opposite round & falciform ligaments, and usually more slightly so opposite fundus of gall-bladder. In recumbent posture & during expiration it usually corresponds to lower border of ribs & costal cartilages, in upright posture & during deep inspirations, especially in women & children, it descends a little lower.

POSTERIOR BORDER — Thick & rounded, especially to the right, in relation with pillars & under surface of diaphragm, to which it is connected by coronary ligament; and with aorta & inferior vena cava, for passage of which latter vessel it is deeply grooved & sometimes channelled.

RIGHT EXTREMITY — Thick & rounded, attached to diaphragm by right lateral ligament; descends lower than the left.

LEFT EXTREMITY — Thin & flattened, attached to diaphragm by left lateral ligament; ascends higher than the right.

LIGAMENTS OF THE LIVER — Five in number:

Round Ligament – The obliterated remains of umbilical vein & ductus venosus. Ascends in free margin of falciform ligament from umbilicus to longitudinal fissure on under surface of liver, where it joins inferior vena cava.

Falciform or Suspensory Ligament
Coronary Ligament . . . .
Lateral or Triangular Ligaments .
} Formed by peritoneum. – Vide Peritoneum.

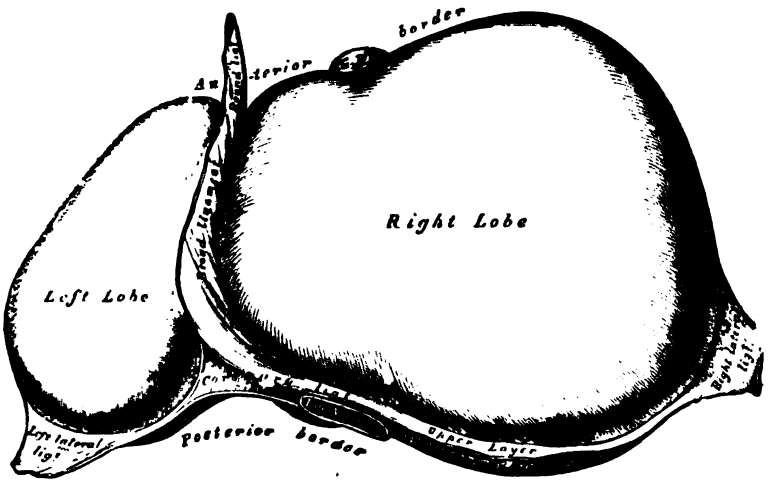


FIG. 309.—UPPER SURFACE OF THE LIVER, AS SEEN IN THE DISSECTING ROOM. (Gray.)

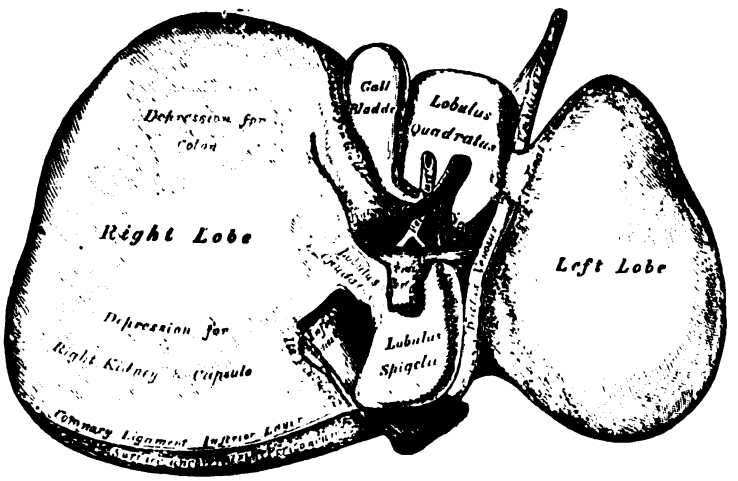


FIG. 310.—UNDER SURFACE OF THE LIVER, AS SEEN IN THE DISSECTING ROOM. (Gray.)

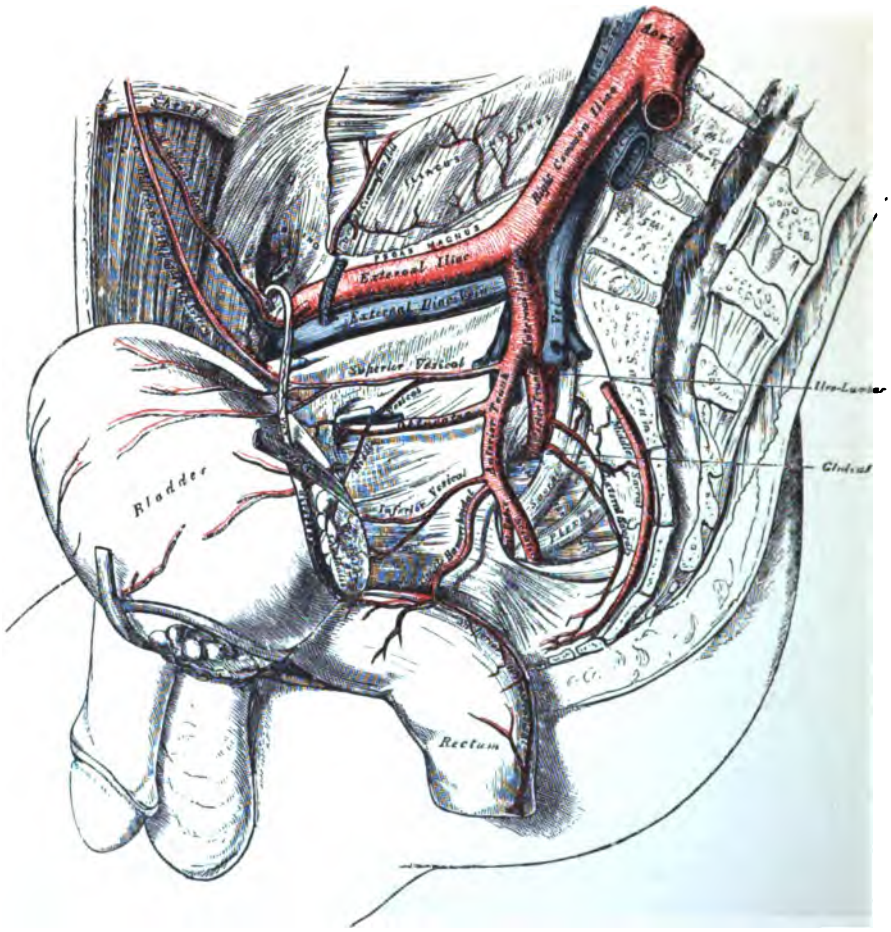


FIG. 311.—THE ARTERIES OF THE PELVIS. (GRAY.)

UNDER SURFACE of the LIVER. —*See Notes, p. 132z.*

Concave uneven, looks downwards & backwards, and covers stomach, duodenum, hepatic flexure of colon, right kidney & right suprarenal capsule.
Presents four fissures, one of which is divided into two, and two primary lobes, of which the right one, or right lobe proper, presents three sub-lobes or lobules.

FISSURES — Are the:

Longitudinal Fissure – Separates right & left lobes, and extends from deep notch on anterior border as far backwards as posterior border. It is divided into:

UMBILICAL FISSURE – Its anterior & deepest two-thirds, situated in front of transverse fissure; contains umbilical vein in the fœtus, and its obliterated remains in the adult. Is often bridged over posteriorly by a band of liver substance, the pons hepaticus.

FISSURE FOR THE DUCTUS VENOSUS – Its posterior & shallowest third; contains the ductus venosus in the fœtus, & its obliterated remains in the adult.

Transverse Fissure – Extends transversely to the right from longitudinal fissure for about two inches, lying nearer to posterior than to anterior border. – It transmits hepatic artery, bile duct, portal vein, lymphatics & nerves, the hepatic artery lying to the left & in front, the bile duct to the right & in front, and the portal vein behind.

Fissure or Fossa of the Gall-Bladder – Shallow, broadest in front, nearly parallel to longitudinal fissure on right side of which it is situated, and extends from anterior border to near right extremity of transverse fissure.

Fissure for the Inf. Vena Cava – Extends from behind lobus caudatus to posterior border of liver, where it joins with fissure for ductus venosus. Is often transformed into a complete foramen, by a prolongation of the lobus Spigelii. It gives exit to the hepatic veins which here open into the inferior cava.

LOBES — Are the:

Right Lobe – The largest. Presents the three last named fissures, and also, further to the right, the *impressio colica* for hepatic flexure of colon, behind which is the *impressio renalis* for right kidney & right suprarenal capsule. – It also presents the three following sub-lobes:

LOBUS QUADRATUS – Situated in front of transverse fissure, between fissure for the gall-bladder & umbilical fissure; quadrilateral & broadest from before backwards.

LOBUS SPIGELII – Situated behind transverse fissure, between fissure for ductus venosus, & fissure for inferior vena cava; more prominent than former, but less regular in shape. Projects into lesser sac of peritoneum.

LOBUS CAUDATUS – A prominent ridge extending from front part of lobus Spigelii to under surface of right lobe proper; forms anterior boundary of fissure for inferior vena cava & upper boundary of foramen of Winslow.

Left Lobe – Is smaller than the right. Its under surface rests upon the stomach, and sometimes extends as far as upper border of spleen.

PORTAL SYSTEM. —*See Notes, pp.* 132n *to* p.

PORTAL TRUNK — Formed by junction of splenic & superior mesenteric veins behind upper border of head of pancreas.

Upwards & to the right in right or free border of lesser or gastro-hepatic omentum, lying between & behind hepatic artery & bile duct, in front of foramen of Winslow. Expands near right extremity of transverse fissure of liver into the *sinus of the portal vein*, and divides into right branch, the larger & shorter, and left branch, the smaller & longer; which branches ramify in portal canals with branches of hepatic artery, bile ducts, deep lymphatics, & nerves. (For distribution of portal vein in the liver and its continuation into the hepatic veins, vide Structure of Liver). – Receives veins:

Gastric & Cystic – The former runs from cardia to pylorus; the latter frequently opens into right branch of portal vein.

Splenic Vein – Arises by five or six branches of considerable size, which emerge from hilum of spleen and join to form one large trunk, which trunk takes a straight course from left to right behind upper border of pancreas, below splenic artery, and, at upper border of right extremity or head of pancreas, joins with superior mesenteric to form the portal trunk. Receives veins:

Inferior Mesenteric (Vide below), *Vasa Brevia*, *Left Gastro-Epiploic*, *Pancreatic & Pancreatico-Duodenal.*

Superior Mesenteric Vein – Arises from area of distribution of superior mesenteric artery, (small intestine, cœcum, ascending portion & right half of transverse portion of colon), its branches corresponding to those of the artery. Its trunk lies to the right & a little in front of the artery, and passes with it in front of transverse portion of duodenum & behind pancreas, and, at upper border of head of pancreas, joins with splenic vein to form the portal trunk.

Inferior Mesenteric Vein – Arises from area of distribution of inferior mesenteric artery (upper part of rectum, sigmoid flexure, descending portion & left half of transverse portion of colon), – its superior hæmorrhoidal branch anastomosing with the middle & inferior hæmorrhoidal branches of the internal iliac & pudic, and thus establishing an important communication between the portal & general venous systems, which communication is supplemented, according to Kiernan, by communications between the right renal vein & the veins of the ascending colon & duodenum, and by communications in the coronary ligament of the liver between the phrenic & the superficial branches of the portal vein. Ascends beneath peritoneum and behind transverse portion of duodenum & pancreas, and opens into splenic.

The portal system contains no valves.

ASCENDING VENOUS TRUNKS.

COMMON ILIAC VEINS — Formed by junction of external & internal iliacs opposite sacro-vertebral articulation (some authors say opposite sacro-iliac synchondrosis). Obliquely upwards, the left one more obliquely than the right, to a little to the right side of intervertebral disc between 4th & 5th lumbar vertebræ, where they unite to form the inferior cava.

RIGHT COMMON ILIAC — Shorter & less oblique than the left one; lies at first behind & then on outer side of its artery. Receives

Tributary Branches: – *Ilio-Lumbar*, & sometimes *Lateral Sacral.*

LEFT COMMON ILIAC — Longer & more oblique than the right one; lies at first on inner side of its artery, and then passes behind artery of right side. Receives

Tributary Branches: – *Ilio-Lumbar*, & sometimes the *Lateral* & *Middle Sacral.* – The common iliac veins have no valves.

INFERIOR VENA CAVA — Formed by junction of the two common iliacs a little to the right side of intervertebral disc between 4th & 5th lumbar vertebræ.

Along right side of aorta in front of right lumbar & renal arteries & right crus of diaphragm, passing in succession behind attached border of mesentery, transverse portion of duodenum, pancreas, & portal trunk.

Through groove or canal in posterior border of liver, where the hepatic veins open into it.

Perforates central or cordiform tendon of diaphragm between its middle & right leaflets.

Enters fibrous bag of pericardium, becomes invested anteriorly by serous layer of same sac, and opens into lower & back part of right auricle near interauricular septum, its opening being guarded by the Eustachian valve. Receives

Tributary Branches: – *Middle Sacral, Lumbar, Renal, Hepatic, Right Spermatic, Suprarenal,* & *Inferior Phrenic,* the middle sacral sometimes opening into the left common iliac.

17

ABDOMINAL AORTA. {Ends at navel.

Curves slightly backwards & to the left from aortic opening in front of 12th dorsal vertebra to a little to the left of 4th lumbar vertebra, where it divides into the two common iliacs.

RELATIONS:

In Front - Lesser omentum, stomach, cœliac axis, solar plexus;
Splenic vein, pancreas, left renal vein;
Transverse portion of duodenum, mesentery, aortic plexus.

Behind - Vertebræ, left lumbar veins, receptaculum chyli, thoracic duct.

To the Right - Inferior vena cava, vena azygos major, receptaculum chyli, thoracic duct, right semilunar ganglion.

To the Left - Cord of sympathetic, left semilunar ganglion.

BRANCHES — Phrenic, Cœliac Axis, Superior Mesenteric;
Suprarenal, Renal, Spermatic;
Inferior Mesenteric, Lumbar, & Sacra-Media.

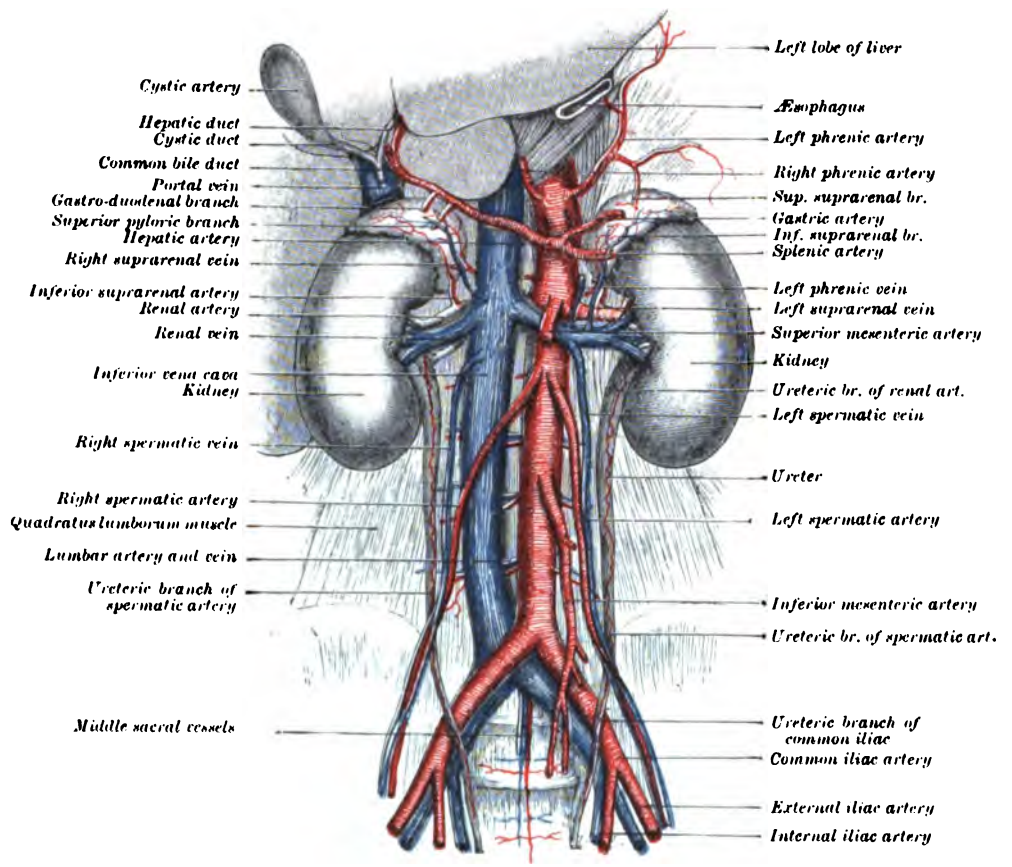


FIG. 314.—THE AORTA AND ITS BRANCHES, AND THE INFERIOR VENA CAVA. (Morris.)

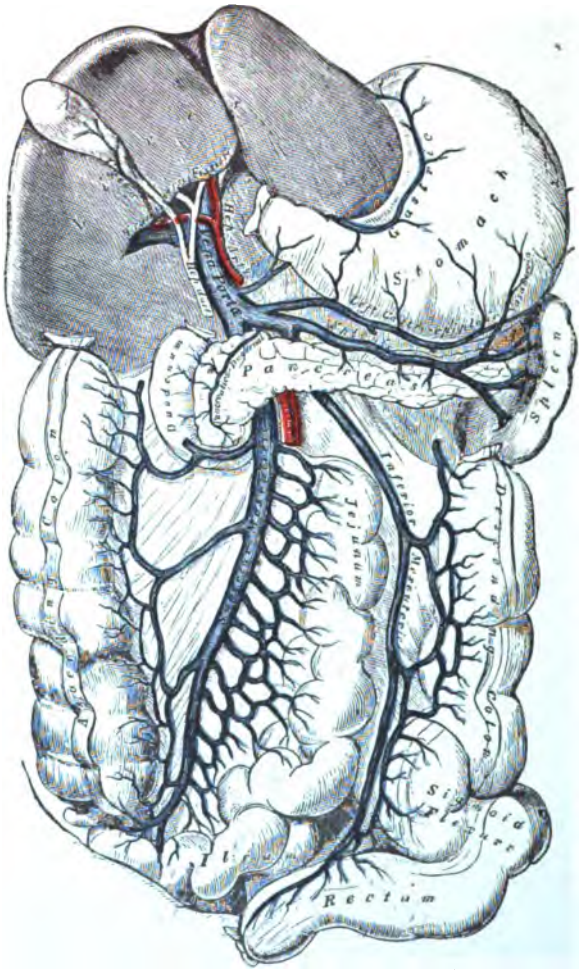


FIG. 313.—THE PORTAL VEIN AND ITS BRANCHES. (Gray.)

BRANCHES of the ABDOMINAL AORTA.

Inferior Phrenic – Two. Arise separately or by a common trunk either from cœliac axis, or from aorta immediately above the latter.
Upwards and outwards behind œsophagus on left side, behind vena cava on right side, to central tendon of diaphragm, and divide into:
INTERNAL BRANCH – To front part of diaphragm communicating with its fellow & with musculo-phrenic.
EXTERNAL BRANCH – To side of thorax, communicating with intercostals.
Gives off small *superior capsular branches* to suprarenal capsule.

Cœliac Axis – Vide p. 115.

Superior Mesenteric – Vide p. 114.

Suprarenal – Two. Small in adult, but in fœtus as large as renal. To suprarenal capsules, anastomosing with capsular branches of phrenic & renal.

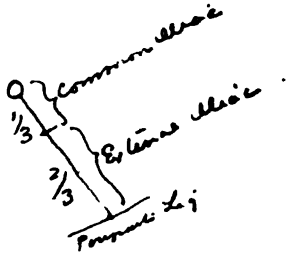
Renal or Emulgent – Two. Large, from sides of aorta just below superior mesenteric.
Nearly horizontally outwards behind renal vein, and divide, each of them, into four or five branches, which penetrate into hilum of kidney in front of pelvis. – Give off small *inferior capsular branches* to suprarenal capsule, and twigs to pelvis & ureter.
Right artery passes behind inf. vena cava, is longer than left one, and lies a little lower.
Renal arteries vary considerably in coincidence with variations of kidneys in situation, size, and number. – They may arise from front of aorta near its bifurcation, or from common or internal iliac; – they may divide into branches sooner than usual, or may be replaced by several arteries which arise separately from side of aorta; – one may be wanting, or there may be a supernumerary artery corresponding to a supernumerary kidney.

Spermatic – Two; long & slender. From front of aorta a little below renal.
Downwards and outwards beneath peritoneum to brim of pelvis crossing psoas & ureter and, on right side, inferior vena cava.
Forwards in front of external iliac artery to internal abdominal ring, being crossed on right side by termination of ileum, on left side by sigmoid flexure of colon.
Through inguinal canal and down to back of testis with other constituents of spermatic cord, becoming tortuous near its termination, and giving twigs to epididymis, which twigs join with artery of vas deferens; pierces tunica albuginea to substance of testis.
OVARIAN ARTERY – In female. Same course down to brim of pelvis, then passes downwards & inwards to attached margin of ovary between layers of broad ligament of uterus; joins with uterine on side of uterus; gives branches to Fallopian tube and twigs to round ligament, which twigs are sometimes continued through inguinal canal to integument of labium & groin.
Both these arteries are short during first part of fœtal life, when testes & ovaries lie just below kidneys, and become elongated only when these organs descend into pelvis.

Inferior Mesenteric – Vide p. 144.

Lumbar – Usually four; from back of aorta.
Round bodies of lumbar vertebræ beneath psoas, the two upper ones passing also beneath pillars of diaphragm, and those of right side beneath inferior vena cava; and divide between transverse processes into:
ABDOMINAL BRANCH – Behind quadratus lumborum (the lowest one sometimes in front), and between abdominal muscles, joining with epigastric, internal mammary, intercostals, ilio-lumbar & circumflex iliac.
DORSAL BRANCH – Sends a spinal branch through intervertebral foramen to cauda equina & posterior surface of bodies of vertebræ, and passes backwards to muscles & integument of back.

Sacra Media – Small; from back of aorta at point of bifurcation.
Descends upon middle of sacrum, anastomosing with both lateral sacral.



COMMON ILIAC ARTERY.

Downwards & outwards from bifurcation of aorta a little to the left of 4th lumbar vertebra to opposite sacro-vertebral articulation (some Authors say opposite sacro-iliac synchondrosis), where it divides into external & internal iliacs. Is about two inches long, the right artery being slightly the longer.

RELATIONS :

Right Side:

In Front – Small intestine, peritoneum, sympathetic nerve, ureter near bifurcation.

Behind – Both common iliac veins.

Outer Side – Right common iliac vein, inferior vena cava, psoas muscle.

Left Side:

In Front – Same, plus rectum & superior hæmorrhoidal artery.

Outer Side – Psoas.

Left Common Iliac Vein – Lies at first on inner side of its artery, and then passes beneath artery of right side.

Right Common Iliac Vein – Lies at first behind its artery, and then on its outer side.

BRANCHES — Very small & not named, sometimes **Renal & Ilio-lumbar.**

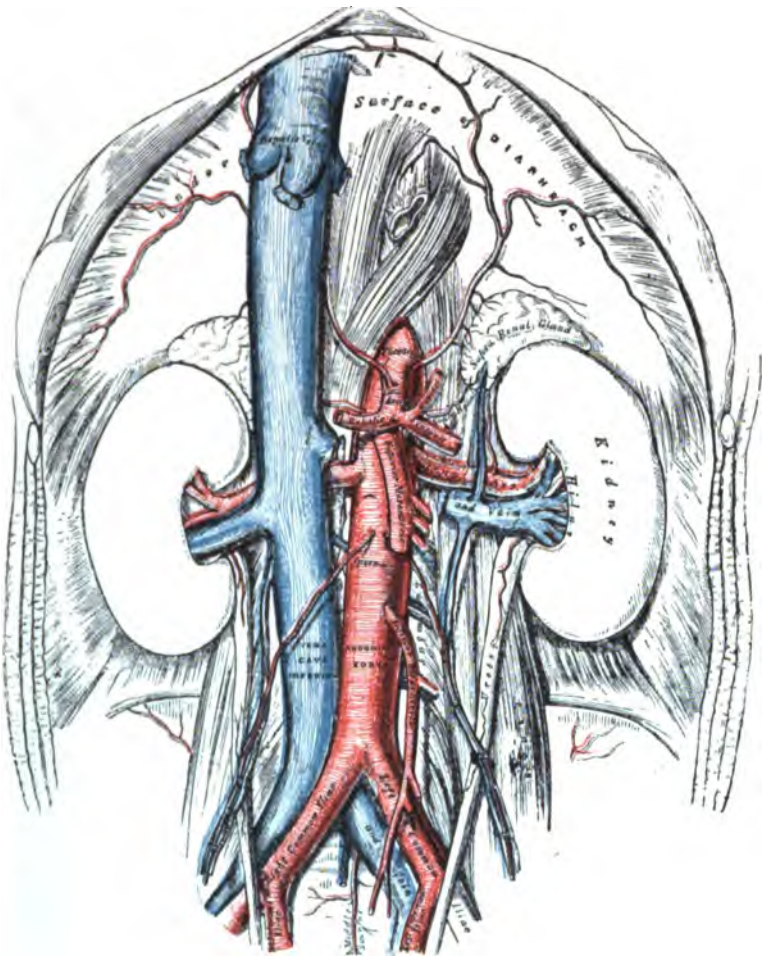


FIG. 314.—THE ABDOMINAL AORTA AND ITS BRANCHES, AND THE INFERIOR VENA CAVA. (Gray.)

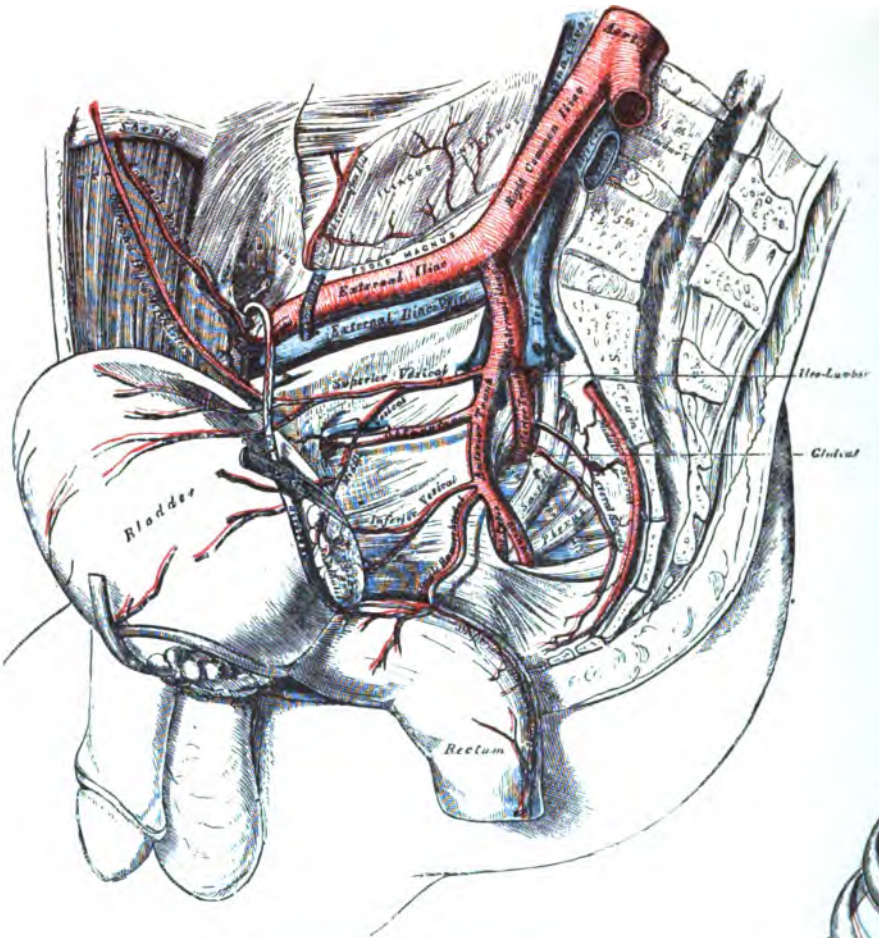


Fig. 315.—The arteries of the pelvis. (Gray.)

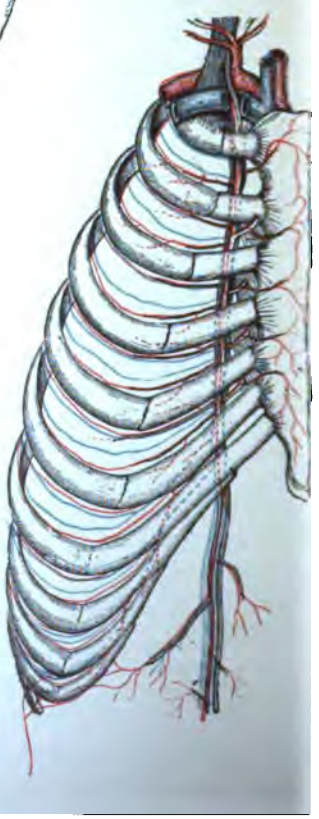


Fig. 316.—The internal mammary and deep epigastric arteries. (Morris.)

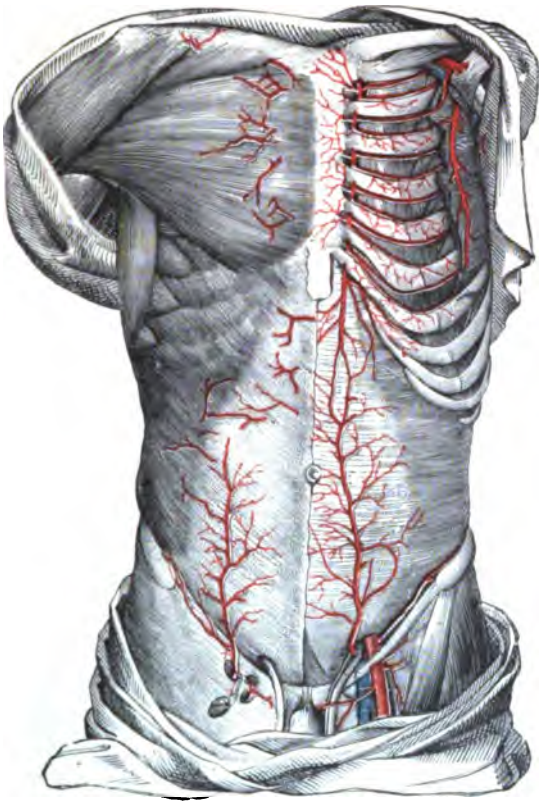


FIG. 317.—THE SUPERIOR, DEEP, AND SUPERFICIAL EPIGASTRIC, AND INTERNAL MAMMARY ARTERIES. (Sappey.)

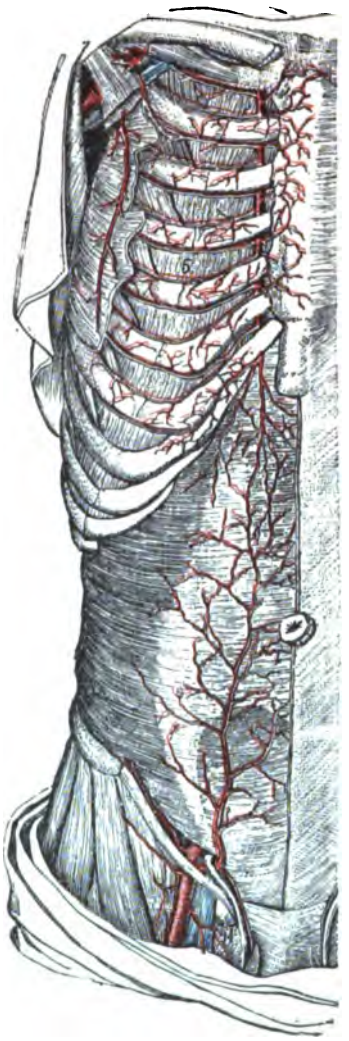


FIG. 318.—THE DEEP & SUPERIOR EPIGASTRIC, AND INTERNAL MAMMARY ARTERIES. (Quain.)

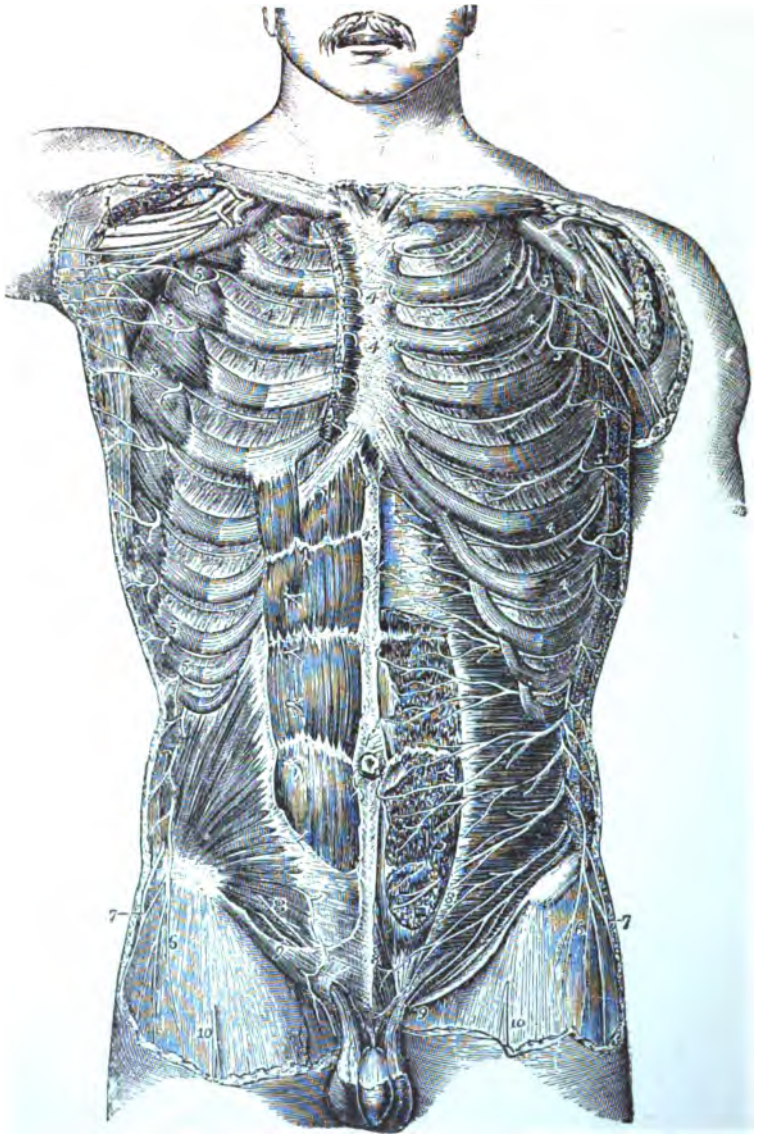


FIG. 319.—7 & 8, ILIAC & HYPOGASTRIC BRANCHES OF THE ILIO-HYPOGASTRIC NERVE; 9, ILIO-INGUINAL NERVE. (Quain, Hirschfeld.)

EXTERNAL ILIAC ARTERY.

Downwards & outwards along inner border of psoas, extending from bifurcation of common iliac opposite sacro-vertebral articulation (some Authors say opposite sacro-iliac synchondrosis) to beneath Poupart's ligament midway between anterior superior spine of ilium & symphysis pubis, where it becomes femoral artery. Rather larger in the adult than internal iliac; half the size in the fœtus.

RELATIONS: —

In Front – Intestine, peritoneum, thin layer of fascia derived from the iliac; spermatic vessels & nerves, genital branch of genito-crural nerve, circumflex iliac vein, sometimes ureter near origin.

Behind on Right Side – External iliac vein, which lies on inner side at femoral arch.

On Inner Side – External iliac vein, & vas deferens.

On Outer Side – Iliac fascia & psoas muscle.

Left External Iliac Vein lies altogether on inner side of its artery.

Right External Iliac Vein lies at first on inner side of its artery, and then behind it.

BRANCHES: —

Back of inguinal canal & between it & pubis

Epigastric – Somewhat the larger. From front of external iliac a few lines above Poupart's ligament.

Descends slightly to reach level of the ligament.

Ascends obliquely upwards & inwards in subperitoneal areolar tissue, passing behind inguinal canal & along lower & inner boundaries of internal abdominal ring, and hooking round vas deferens in the male, round round ligament in the female.

Pierces sheath of rectus between its middle & lower thirds, and ascends behind the muscle, dividing into muscular & cutaneous branches, which anastomose with lower intercostals, lumbar, superior epigastric of internal mammary, & superficial epigastric of femoral. – Gives off branches:

Cremasteric – Small, descends upon spermatic cord and supplies cremaster; anastomoses with spermatic.

Pubic – Usually small; descends behind pubes on inner side of femoral ring, and anastomoses with obturator. Sometimes greatly increased in size so as to form the origin, or one of the origins, of the obturator artery, which artery is then said to arise from the epigastric (Vide obturator artery). – The two epigastric veins unite into one trunk, which opens into the external iliac.

Circumflex Iliac – Somewhat the smaller. From outer side of external iliac near Poupart's ligament.

Upwards & outwards behind the ligament, and along anterior half of inner lip of crest of ilium, joining with gluteal.

Pierces transversalis, runs backwards between it & the internal oblique, and joins with ilio-lumbar. Gives off numerous muscular branches; one, rather large, ascends from anterior superior spine of ilium, and joins with the epigastric & lumbar. – The two circumflex iliac veins unite into one trunk, which crosses the external iliac artery and opens into the corresponding v.

FIG. 321.—THE DIAPHRAGM FROM IN FRONT. (Wilson.)
1, opening for inferior vena cava; 2, œsophagus; 3 and 4, aorta.

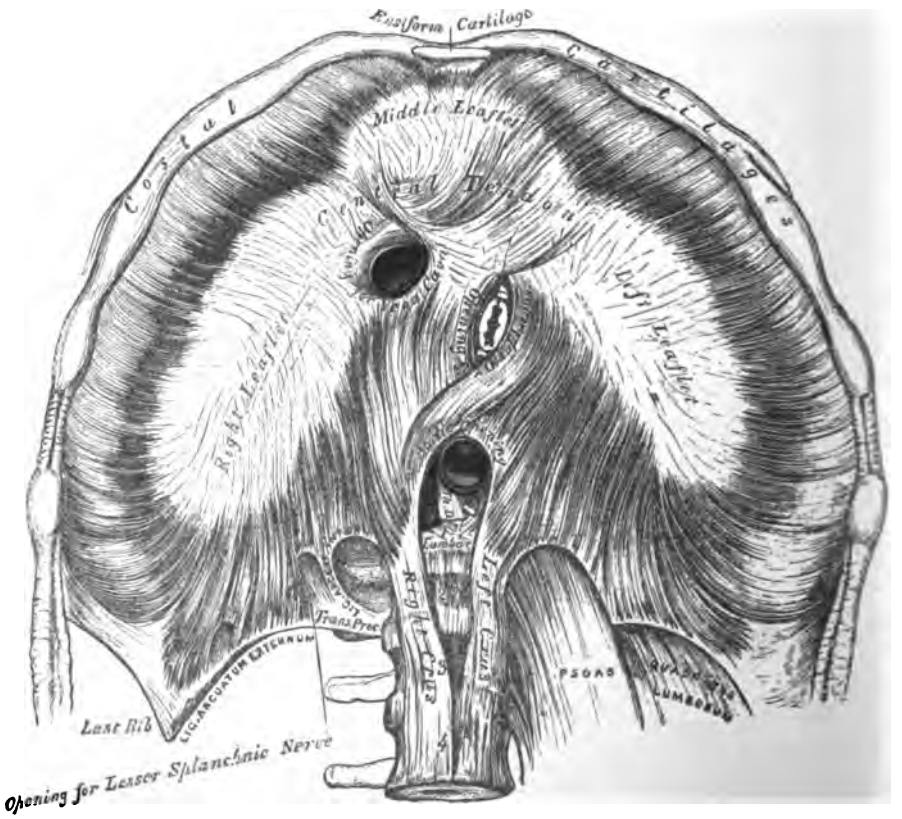


FIG. 322.—THE DIAPHRAGM, UNDER SURFACE. (Gray.)

LATERAL BRANCHES of the LUMBAR PLEXUS.

ILIO-HYPOGASTRIC — From 1st lumbar.

Emerges from *upper part of outer border of Psoas.*

Crosses quadratus lumborum.

Perforates transversalis, and divides between it & internal oblique into branches: –

ILIAC – Pierces internal & external oblique just above crest of ilium, and supplies skin of gluteal region behind lateral cutaneous branch of twelfth dorsal nerve.

HYPOGASTRIC – Forwards between internal oblique & transversalis, communicating with ilio-inguinal. Pierces internal oblique & aponeurosis of external oblique a little above the external abdominal ring, and supplies skin of hypogastric region.

ILIO-INGUINAL — From 1st lumbar; smaller than foregoing.

Pierces psoas, and crosses quadratus lumborum *immediately below ilio-hypogastric.*

Pierces transversalis, and communicates with hypogastric branch of ilio-hypogastric between that muscle and the internal oblique, which it pierces a little further on.

Through inguinal canal in front of spermatic cord; and supplies skin of upper & inner part of thigh and of scrotum & penis, or of labium pudendi.

Is sometimes small, and then ends by joining the ilio-hypogastric near crest of ilium; in that case a branch of the ilio-hypogastric takes the place of the ilio-inguinal.

GENITO-CRURAL — From 2nd lumbar nerve, and by a few filaments from the 1st.

Descends obliquely *through substance, and afterwards on anterior surface of psoas,* and divides into branches: –

GENITAL – Over external iliac artery, and through inguinal canal behind spermatic cord, to cremaster muscle & scrotum; – in female behind round ligament to labium.

CRURAL – Beneath Poupart's ligament on inner side of psoas. Pierces fascia lata on outer side of femoral artery, and supplies skin of upper and front part of thigh; communicates with middle cutaneous.

EXTERNAL CUTANEOUS — From 2nd lumbar nerve, and, by a few filaments, from the 3rd.

Pierces psoas muscle towards its middle and crosses iliacus.

Passes beneath Poupart's ligament through notch below anterior superior spine of ilium, and divides into branches: –

ANTERIOR – Pierces fascia lata about four inches below Poupart's ligament, and supplies skin of anterior & outer aspects of thigh as low as knee.

POSTERIOR – Supplies skin of outer & posterior aspect of thigh.

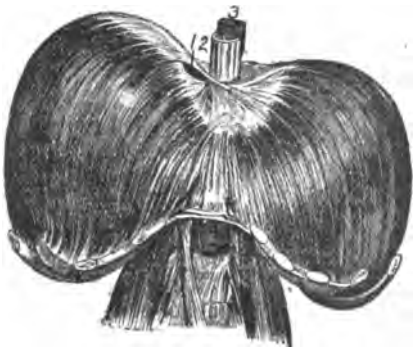


FIG. 821.—THE DIAPHRAGM FROM IN FRONT. (Wilson.)
1, opening for inferior vena cava; 2, œsophagus; 3 and 4, aorta.

Added, 1897.

LATERAL BRANCHES

ILIO-HYPOGASTRIC

ATTER.

TED" ABDOMEN.

ructed' Abdomen" **seems justified by the crowd**
on the so-called "**reconstruction method.**" **It is**
injection of chromic **acid, corrosive sublimate,**
eatly harden the **solid viscera to allow of the**
like" or "**reconstructed" forms. The method is**
esults already attained **may safely be taken as**

lf responsible for the **descriptions given, which,**
ly one with the other. **Taken, however, as they**
es them to be, *in the main*, **correct** ***within the limits of***
ferable to the "reconstructed" data obtainable through*
en or otherwise hardened subjects. **They are of course**
the practitioner. The **subject-matter they embody is**
way commendable, as far **as it is inspired by a love**
sake, and irrespectively of the **advantages,** ***or disadvantages,***
n examination-subject, on those **who are about to be called**
contended, however, that the **pressing of such subject-matter**
annot be looked upon otherwise than **as a direct inducement**

be found supported under the Roman **numerals III., IV., and V.,**
th.

See page 1326

THE DIAPHRAGM.

Is fan-shaped; the expanded portion of the fan being horizontal, and the narrow portion or handle, vertical. It presents for examination its points of origin & the fibres arising from them, its central cordiform tendon, its openings, & its relations.

POINTS OF ORIGIN & FIBRES ARISING FROM THEM:

Ensiform Cartilage – Gives attachment to a narrow & sometimes tendinous slip, on either side of which the costal cartilages & the costal fibres bound a narrow triangular area, over the extent of which area the pleuræ & the peritoneum are separated only by a little areolar tissue.

Cartilages & Osseous Portions of the 6 or 7 Lower Ribs – Give rise to the long arched lateral fibres, which, at their point of origin, interdigitate with the transversalis.

Ligamentum Arcuatum Internum – A thickened band of the fascia over the psoas, extending from side of body of 1st, & sometimes from that of 2nd lumbar vertebra, to tip of transverse process of 1st & sometimes to that of 2nd. Gives rise to arched fibres similar but rather shorter.

Ligamentum Arcuatum Externum – A thickened band of the fascia over quadratus lumborum (anterior lamella of posterior abdominal aponeurosis), extending from tip of transverse process of first lumbar vertebra, & sometimes from that of 2nd, to lower border & apex of last rib. Gives rise to similar arched fibres.

Bodies of Second, Third & Fourth Lumbar Vertebræ by means of the

CRURA — Two thick fibro-muscular bundles, which arise by tendinous fibres as follows:

RIGHT CRUS – The thickest & longest, from front of bodies & intervertebral substances of 1st, 2nd, & 3rd, or sometimes of 2nd, 3rd, & 4th lumbar v., & from ant. common ligt. of spine.

LEFT CRUS – The shortest & narrowest, from left side of bodies & intervertebral substances of 1st & 2nd or sometimes of 2nd & 3rd lumbar vertebræ, & from ant. common ligt. of spine.

The tendons ascend for a short distance on either side of the aorta, and then become joined in front of that vessel by means of a tendinous arch formed by the blending of their innermost fibres. The crura then give rise, as well as the intervening arch to two large fleshy bellies, the outer fasciculi of which bellies pass upwards & outwards to the cordiform tendon, while the inner ones first decussate in front of the aorta (those of the right side being the largest & most anterior), then diverge to surround the œsophagus, and finally meet again in front of it before they end in the central tendon. (In some very rare cases these fasciculi do not join in front of the œsophagus, a portion of the anterior margin of the œsophageal opening is then tendinous).

CENTRAL or CORDIFORM TENDON — The common insertion of all the fibres. Has somewhat the shape of a trefoil leaf; and presents anteriorly three leaflets; the right one is long, broad, & the largest; the left one, long, narrow, & the smallest; the middle one short, broad, & intermediate in size.

OPENINGS — Are:

Large Openings – Three:

AORTIC OPENING – For aorta, vena azygos major, thoracic duct & frequently the left cord of the sympathetic. Lies in middle line, and is osteo-fibrous, being bounded behind by bodies of vertebræ, laterally by tendons of the crura, and in front by the fibrous arch which joins the latter.

ŒSOPHAGEAL OPENING – For œsophagus & pneumogastric nerves. Lies higher up, & a little to the left. Is oval in form & entirely muscular, being formed by the inner decussating fasciculi of the fleshy portion of the crura; – in some very rare cases a portion of the anterior margin is fibrous, & formed by the posterior border of cordiform tendon.

OPENING FOR INFERIOR VENA CAVA – The highest; lies a little to the right between right & middle leaflets of cordiform tendon. Is quadrilateral & fibrous, being bounded by four bundles of tendinous fibres which meet at right angles.

Small Openings – Transmit;

Right cord of sympathetic, & sometimes the left;

Right & left great, lesser, & least splanchnic nerves, either separately or conjointly.

Vena azygos minor, & sometimes the major – These openings vary therefore in number.

RELATIONS —

Of Upper Surface:

LATERALLY – Pleuræ; lungs. Also at circumference of thorax for a considerable though variable extent, lower ribs & lower intercostal spaces, the lungs not descending under ordinary circumstances as low as the costal attachments of the diaphragm & the point of reflection of the pleuræ. The lateral portions of the diaphragm are the most movable; their degree of elevation or depression varies much more than that of the central part in accordance with the respiratory movements, and with the degree of distension, or otherwise, of the stomach, intestines, & uterus. The right lateral portion of the diaphragm, on account of the pressure of the liver on that side, rises by one or two ribs' breadths higher than the left, and reaches the level of

In Forced Expiration – 4th costal cartilage;

In State of Repose of Thorax – 5th costal cartilage;

In Forced Inspiration – Line from ensiform cartilage, to back of 10th rib.

CENTRALLY – Heart & base of pericardium, the fibrous layer of which latter sac blends more particularly with the anterior & left part of central leaflet of cordiform tendon, & with the fascia covering the left anterior costal fibres. The central part of the diaphragm is flattened & less movable, and lies on a lower level than the lateral portions, except close to the sternum, in front, & to the vertebræ, behind, where, on the contrary, it rises a little higher.

Of Under Surface – This is entirely covered by peritoneum except behind pancreas, kidneys & suprarenal capsules, and at points of attachment of coronary & lateral ligaments of liver, gastro-phrenic ligament, & suspensory ligament of spleen; it lies in mediate contact with liver, stomach & spleen.

Added, 1897.

NOTES ON THE NEWER MATTER.

THE NEW OR "RECONSTRUCTED" ABDOMEN.

The phrase "The New or 'Reconstructed' Abdomen" seems justified by the crowd of modified relations now given, based upon the so-called "reconstruction method." It is easy, by freezing, or by the prolonged injection of chromic acid, corrosive sublimate, formalin, and other reagents, to sufficiently harden the solid viscera to allow of the examination of their preserved "life-like" or "reconstructed" forms. The method is still somewhat a new one; but the results already attained may safely be taken as submitted further on.

The Author does not hold himself responsible for the descriptions given, which, indeed, do not, in some respects, tally one with the other. Taken, however, as they are, from the best sources, he believes them to be, *in the main*, correct *within the limits of their true significance,—that is, as referable to the "reconstructed" data* obtainable through the examination of numerous frozen or otherwise hardened subjects.* They are of course unverifiable by the student or the practitioner. The subject-matter they embody is an object of study in every way commendable, as far as it is inspired by a love of knowledge for knowledge' sake, and irrespectively of the advantages, *or disadvantages*, of pressing the same, as an examination-subject, on those who are about to be called to medical practice. It is contended, however, that the pressing of such subject-matter in the *latter aspect* cannot be looked upon otherwise than as a direct inducement to "cram."

The view will be found supported under the Roman numerals III., IV., and V., pages 132cc to 132hh.

* See page 132cc.

corresponds to the tenth and eleventh dorsal vertebræ, and to the cardiac depression on the posterior surface of the liver. It is situated posteriorly to and to the left of the aorta, and lies some four or five inches behind the interval between the ensiform process and the inner end of the seventh costal cartilage. (Professor Cunningham places the opening a little further outwards, posteriorly to the seventh costal cartilage *an inch* from the sternum.)

The pylorus lies about four and a half inches below the lower end of the gladiolus, half an inch above the subcostal plane (Cunningham). Its position laterally, its displacements, and its varying inclinations have been referred to.

The tendency to sacculation near the pylorus (depressions with intervening prominences, sometimes two or three in number) is explained by the bending backwards described. Such markings disappear on distention, and are not to be confounded with the constrictions due to local contractions of the muscular fibres, which constrictions are more or less permanent; these may divide the stomach into two parts (hour-glass shape).

A small portion of the stomach just behind the cardia is uncovered by peritoneum, and lies in direct contact with the diaphragm, occasionally with the suprarenal capsule. The reflections of the peritoneum at the boundaries of this area constitute the so-called *gastro-phrenic ligament*.

Fluid injected through the œsophagus, – if the stomach be once distended, – does not return, though the œsophagus be unobstructed. The cardia would thus seem to be the seat of a kind of *valvular action:* After piercing the diaphragm, the œsophagus bends abruptly backwards and to the left to reach the cardia, and it would seem probable that, in distention, this bend may be increased to a kink.

II.—DUODENUM.

The duodenum is largely influenced by the condition of distention, or otherwise, of the stomach. When the stomach is empty, the commencement of the duodenum, – the movable pylorus, – shifted (relatively) to the left, – lies only a little above and to the right of the fixed duodeno-jejunal flexure; the duodenum then describes an almost complete circle. When, on the stomach being distended, the pylorus is again carried to the

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stomach lies in the left hypochondriac, epigastric, *and part of the right hypochondriac* regions"? When distended, – and even when not distended (Birmingham), – the stomach *does* lie, *in part, in the right hypochondriac region*, according to the very showing of the scientists; the stomach is therefore not nearly so vertical as is generally made out.

The question of the delimitation of the several abdominal regions is an old and vexed one. But, if arbitrary divisions are necessary, the division which was largely brought to the front by the labours of Professor Cunningham, is probably the best. It is by means of two vertical *mid-Poupart planes*, and two horizontal planes passing, one through the most dependent part of the tenth costal arch, – *subcostal plane*, – and the other through the highest part of the iliac crest, – *intertubercular plane*, – there being here a distinctly perceptible tubercle which juts out from the outer lip of the crest about two inches behind the anterior superior iliac spine. This settlement of a long-disputed question is worth noting.

right, the duodenum becomes U-shaped. The duodenum lies in a coronal plane, except at or near its extremities, which turn more or less directly forwards.*

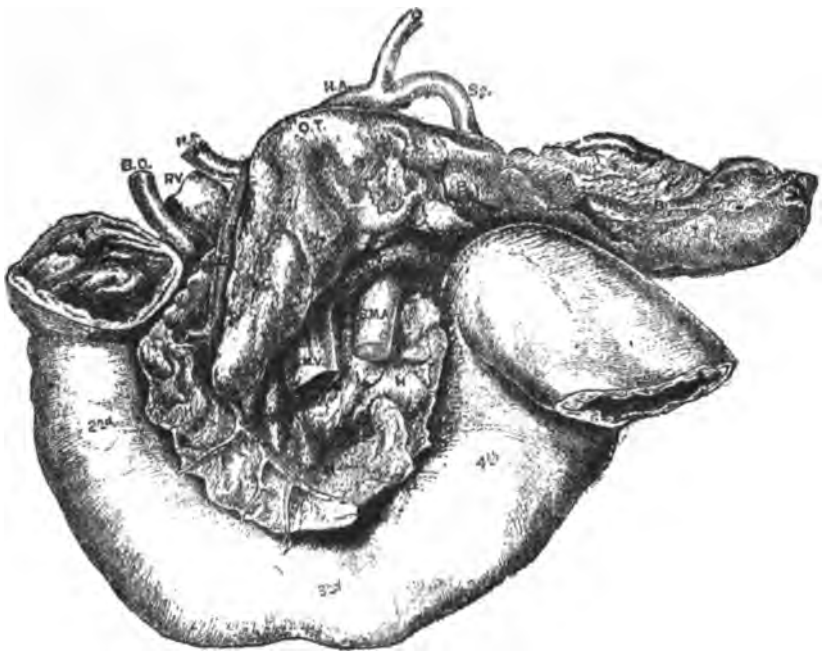

FIG. 322c.—VIEW OF THE PANCREAS AND DUODENUM FROM BEFORE. (Symington, Quain.)

H, H, H, head ; C, neck ; B, B, body of the pancreas ; A, I, anterior and inferior surfaces of body ; O.T., omental tuberosity ; 2nd, 3rd, 4th, second, third, and fourth portions of duodenum ; J, jejunum ; H.A., G., Sp., hepatic, gastric, and splenic arteries ; G.D. and S.P.D., gastro-duodenal and superior pancreatico-duodenal arteries ; S.M.A., S.M.V., superior mesenteric artery and vein ; S.V., splenic vein ; I.M., inferior mesenteric vein ; P.V., portal vein ; B.D., bile-duct.

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* This also is disputed by Prof. Birmingham, who shows in his cast that nearly half the duodenum, including the whole of its descending portion, lies in a plane not far from sagittal, contrary to what pertains in His's model. Nor is the view in any way supported by the said cast as to an almost complete circle being formed by the duodenum when the stomach is empty. In the cast, though the stomach be empty, the duodenum is distinctly U-shaped, this being the necessary consequence of the position of the pylorus over two centimetres to the right of the median plane. (See page 132u.)

Prof. Birmingham's cast must not be taken to negative the *variations* of position of the first portion of the duodenum. The cast merely shows that the starting point of these variations is different from what is usually stated.

The duodenum is divided into four portions (Symington, Quain), or into three portions only (Cunningham).

The First Portion is very variable, – its length, direction, and position depending on the condition of the stomach and consequent position of the pylorus. With the empty stomach, and the pylorus over to the left, the first portion of the duodenum is about two inches long, and angular in direction. It first passes to the right, under the quadrate lobe of the liver, continuing the direction of the pyloric portion of the stomach. It then curves backwards beneath the neck of the gall-bladder, where it bends sharply

Fig. 322D.—View of the duodenum from before. (Quain, after Lushka.)

p, placed on the first portion of the duodenum, points to the pyloric opening seen from the side next the stomach; *d*, on the second portion, indicates the termination of the common bile and pancreatic ducts; *d'*, third and fourth portions; *j*, commencement of the jejunum; *m*, superior mesenteric artery. (The pylorus and the first portion of the duodenum are seen in the position they occupy when the stomach is distended.) *a*,*a*, abdominal aorta; *v*, *v*, inferior vena cava.

downwards to join the second portion. With the distended stomach, and the pylorus more or less over to the right, the direction of the first portion of the duodenum is backwards almost from the first, and its length is reduced to an inch or less. Below, and to the right of, the first portion of the duodenum, are the neck of the pancreas, and the gastro-duodenal artery; directly behind it are the hepatic artery, bile-duct, and portal vein; above and in front are the liver and the gall-bladder. (See p. 132n.)

The Second Portion is fixed, and about three inches long. Beginning opposite the neck of the gall-bladder, on the right side of the first lumbar vertebra, it passes down the right side of the spine to the level of the third or fourth lumbar vertebra, where it turns more or less sharply upwards and to the left to join the third portion. Posteriorly

it rests on the inner part of the right kidney, the right renal vessels, and the inferior vena cava.* (The relations to the right kidney and renal vessels are very variable as to level, this being due to displacements principally of the kidney – Cunningham.) To the right is the hepatic flexure. In front is the transverse colon. To the left are the head of the pancreas, and the common bile and pancreatic ducts.

The peritoneal covering is anterior only, and is variable and interesting. The transverse mesocolon of course crosses over in front; but it usually leaves the smaller gut covered by peritoneum, except over a narrow area separating the two layers of the peritoneal fold. Sometimes this area widens out considerably, owing to the imperfect development of the mesocolon, – sufficiently indeed, when the mesocolon is quite short, for there to be scarcely any peritoneal covering at all; only connective tissue then separates the duodenum from the colon.

The THIRD, TRANSVERSE, OR, MORE PROPERLY, OBLIQUE PORTION inclines slightly upwards and to the left from the right side of the third or fourth lumbar vertebra to the left side of the *aorta*, where it joins the ascending or terminal portion. This third portion lies upon the aorta and the inferior vena cava. Above it is the head of the pancreas. Its anterior aspect is covered by peritoneum at its commencement, but near the median plane the anterior layer of the mesentery is separated from it by the superior mesenteric vessels which cross it.

The FOURTH OR ASCENDING PORTION passes up on the left side of the aorta till it reaches the left side of the second lumbar vertebra, where it bends forwards to join the jejunum, forming the duodeno-jejunal flexure. It rests on the left psoas muscle, sometimes extending over the left renal vessels and the inner border of the left kidney. On its left side the peritoneum, which covers it but incompletely, often forms one or two small pouches, the duodeno-jejunal fossæ. (See p. 1820o.)

It will be seen that no precise boundary separates the third and fourth portions of the duodenum. Sometimes, indeed, the third portion crosses the spine so obliquely that it is almost in a line with the fourth portion (Y-shaped duodenum). Hence these two portions being joined into one by some anatomists, – by Professor Cunningham, among others.

The termination of the duodenum is said to be held in position by the *musculus suspensorius duodeni*, this being a "strong fibrous band" (Quain) containing plain muscular fibres arising from the left crus of the diaphragm (Professor Cunningham says from the *right crus*), and from the tissue around the cœliac axis.†

III.—LARGE INTESTINE.

The three bands of the large intestine meet at the root of the vermiform appendix, which, in the fœtus, continues the axis of the then conical cæcum.

CÆCUM.—The *fœtal type* of cæcum may persist in the adult. But as a rule the anterior and right portions of the cæcal wall grow most rapidly. The free rounded

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* Professor Birmingham's cast shows that the second portion of the duodenum lies *on the right side* of the inferior vena cava, and not in front of it.

† The author would much like to see the strong fibrous, or muscular, band in question. He has not yet come across it – nor has he knowingly met with the anatomist who has *personally* seen it *in the dissecting room*.

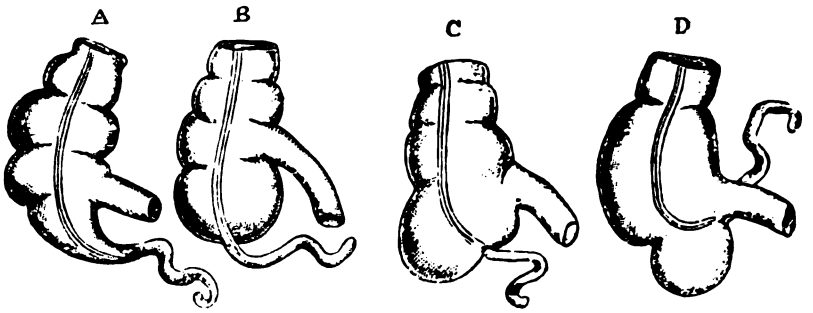

FIG. 322E.—THE THREE TYPES OF CÆCUM. (Treves.)

A, the fœtal type; C, the more usual type, as described below; B, a less usual form, in which the two anterior saccules are equally developed; D, a rare form, in which the development of the left anterior saccule is excessive, while the right one is atrophied.

lower end of the adult cæcum thus comes to be formed by the expanded saccule between the anterior and posterior bands, and the attachment of the appendix gets to lie at the inner and posterior part. (C in Fig. 322E.)

The cæcum is usually covered all round by peritoneum. Posteriorly, the peritoneum leaves the bowel at the level of the ileo-cæcal orifice, sometimes a little higher.

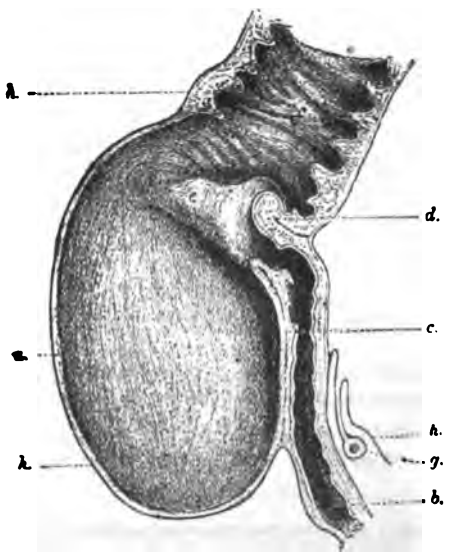

FIG. 322F.—RELATIONS OF THE CÆCUM WITH THE ILEUM. (Symington, Quain.)

a, cæcum; *b*, ileum; *c*, lower segment of ileo-cæcal valve; *d*, upper segment; *e*, right or posterior frænum; *f*, ascending colon; *g*, vermiform appendix with its mesentery; *h*, peritoneum.

In about five per cent. of the cases the reflection of the peritoneum occurs at a lower level, the posterior aspect of the cæcum then being more or less uninvested by peritoneum, and connected with the iliac fascia by areolar tissue only.

As will be seen below, the ileo-cæcal valve differs considerably in the fresh condition from what is represented in Fig. 305, page 118a, where it is shown in the dried inflated specimen.

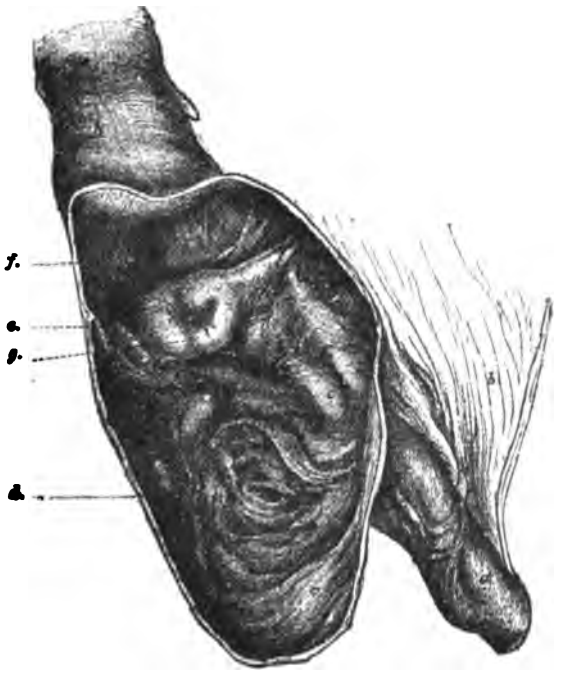

FIG. 322c.—THE INTERIOR OF THE FRESH CÆCUM. (Symington, Quain.)

a, ileum; *b*, its mesentery; *c*, *c*, cæcum; *d*, opening of vermiform appendix; *e*, ileo-cæcal valve; *f*, its upper lip; *g*, its lower lip; *h*, ascending colon.

The distended cæcum comes in contact with the anterior wall of the abdomen just above the outer half of Poupart's ligament.

The ileo-cæcal valve lies opposite a point on the anterior abdominal wall one or two inches internal to, and a little above, the anterior superior spine of the ileum.*

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* Prof. Cunningham places the ileo-cæcal valve just to the right of the right mid-Poupart plane immediately above the intertubercular plane. He places the opening of the vermiform appendix *in* the right mid-Poupart plane immediately *below* the intertubercular plane.

The HEPATIC FLEXURE lies lower down, and more superficially than, the splenic flexure. On reaching the under surface of the liver on the right side of the gall-bladder, the colon bends forwards on the right side of, and then to the left in front of, the second portion of the duodenum.

The SPLENIC FLEXURE lies higher up and deeper than the hepatic flexure, in contact with the lower part of the spleen (*pancreatico-colic*, – Professor Cunningham's *basal*, – surface) and with the under surface of the pancreas; a crescentic fold of peritoneum, the *phreno-colic ligament* or *sustentaculum lienis*, attaches it to the diaphragm opposite the tenth and eleventh ribs.

The intervening TRANSVERSE COLON is arched in two different planes. Towards its middle, it lies nearer to the surface, and at the same time at a lower level, than at either extremity.

The ascending colon has a mesentery in 26 cases in a hundred (Treves). It is otherwise covered by peritoneum in front and at sides only, and joined by connective tissue to the right quadratus lumborum and lower part of the right kidney.

The descending colon has a mesentery in 36 cases in a hundred (Treves). In the fœtus it presented a distinct mesocolon attached to the *inner* border of the left kidney. But after birth this became obliterated, probably by fusion with the peritoneum on the posterior wall of the abdomen.

The SIGMOID COLON is the part of the large intestine extending from the iliac crest to the brim of the pelvis. Its first two or three inches are relatively fixed by

FIG. 322H.—A TRANSVERSE AND NEARLY VERTICAL SECTION THROUGH THE LOWER PART OF THE MALE PELVIS AND THE BUTTOCKS. (Symington, Quain.)

B, bladder; V.D., V.S., vas deferens & vesicula seminalis; R, second portion of rectum; A C., anal canal; L.A., levator ani; I.S., E.S., internal and external sphincters.

an imperfect peritoneal covering, and lie close to the anterior abdominal wall a little internal to the antero-superior iliac spine. The remainder, which has a long mesocolon, is very movable. It may hang down into the pelvis, or be pushed up into the abdomen sometimes as high as the umbilicus or the liver; it may join the first portion of the rectum to form the omega loop (Treves). This portion may properly be termed the *sigmoid loop* (Quain.)

The RECTUM proper extends from the sigmoid loop to the *anal canal*, and is divided into *two* portions, neither of which requires any further description than has already been given. (See p. 137.)

The ANAL CANAL (the new designation of the former third part of the rectum) begins where the gut turns backwards below and behind the prostate, in which situation it may present a blind recess reaching forwards in the male to near the urethra. It passes downwards and backwards to the anus, and is about an inch in length. It is flattened *from side to side* (Fig. 322H), while the rectum proper is flattened *from before backwards*.

Its mucous membrane is thrown into four or five longitudinal folds, the columns of Morgagni, which contain some longitudinal muscular fibres. At the anus the epidermis is continued for a short distance into the canal, but by degrees it becomes thinner, and is gradually replaced by the columnar cells of the mucous membrane. The anus is surrounded by a ring of large sudoriparous or circumanal glands.

TRANSVERSE FOLDS OF THE MUCOUS MEMBRANE OF THE RECTUM, OR SO-CALLED FOLDS OF HOUSTON AND KOHLRAUSCH.

Without pretending to be a high authority on the rectum, the Author ventures to say that he has examined probably as many recta as most men, and that, to his mind, the genesis of these transverse folds, when present, – present to the surgeon's finger, – is simple in the extreme. They proceed from chronic constipation, and its natural mechanical consequences. In support of the view, the Author would remark that the folds are only found in dyspeptic persons given to the use of purgatives and enemata, and that they occur, – when they do occur, – in the several concavities natural to the rectum especially when distended, that is at points where, after the use of the remedies mentioned, the hardened scibala would impinge with more or less force on the intestinal wall, and drag down the mucous membrane. The rectum, or omega-loop, as it is first directed downwards and to the right, more or less passes the median plane, and, in regaining it, forms a first concavity to the left: here is the highest and largest fold, the so-called fold of Kohlrausch. A second concavity may be present a little lower down on the left side: here is the second fold. A third concavity occurs where the gut bends backwards opposite the prostate: here occurs the third and last fold. With so simple an explanation of all the facts of the case, where can be the reason for further and meaningless additions to the anatomy of the rectum, which student and practitioner can see nothing of, and can but cram up from books – for what Patteson very properly calls "exasperating details"? Writes R. G. Patteson, Surgeon to Meath Hospital:—

"Anatomy is not taught as the handmaid of Surgery, but as a separate science bristling with technicalities and overloaded with trivial and exasperating details. Hence it is unwillingly learnt, and readily forgotten. And the vast majority of facts, which are all-important in surgery, are soon engulfed in the wreckage which follows the emancipation of an over-burdened memory when the examination is passed."

IV.—LIVER.

To the liver there are now described anterior and right surfaces, in addition to the upper, under, and posterior surfaces referred to in a previous edition. (*See further description of the Liver, p.* 1322.)

The *anterior surface* of the liver is triangular. It is separated from the under surface by a sharp margin – margo acutus (formerly termed the anterior border) – but is continued into the upper and right surfaces over borders effaced and rounded. It is crossed a little

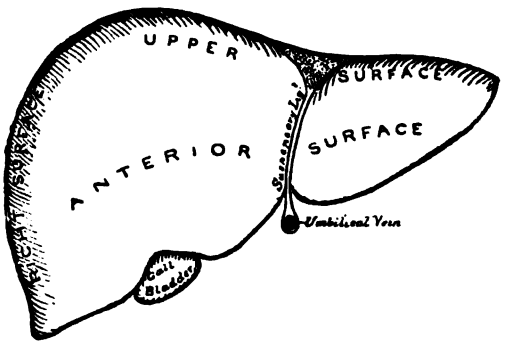

FIG. 1221.—THE ANTERIOR SURFACE OF THE LIVER.

to the left by the attachment of the suspensory or falciform ligament passing up from the umbilical notch. Inferiorly and to the right, it is slightly notched for the fundus of the gall-bladder.

The *right surface* is more quadrilateral. It is distinctly convex from before backwards, and slightly so from above downwards; it is separated by rounded borders from the upper and anterior surfaces, and separated from the under surface by the margo acutus.

It must be confessed that the description of anterior and right surfaces to the liver is by no means displeasing. On simply removing the abdominal wall, anterior and right aspects are clearly discernible. The objection to their being treated as *surfaces* is that they are not separated from each other, or from the upper surface, by anything like definite borders. If, however, the anatomist likes to stretch formerly accepted canons of description, it is open to him to do so. We are here on ground of common observation. And the anatomist is describing what he sees, and anyone can see after him. This is legitimate.

Of a completely different character, however, is the description of new surfaces and facets to the organs whose description follows. These are *not* to be seen, except by the few who can provide themselves with the luxury of hardening the internal organs before they are got at. It is, to the Author's mind, this basing anatomical descriptions on what only the few can see, that is at the root of present evils to medical and surgical education. What is needed in medical practice is the anatomy that *every man* can himself see and handle, and that *every man*, if he is true to his profession, will see and handle throughout. But of what use can that be for the guidance of all, with which only the few can be familiar, and others can learn about at best by mere reading?

V.—PANCREAS.

The pancreas presents head, *neck*, body, and tail.

The HEAD is disc-shaped, and flattened from before backwards. It lies in the concavity of the second, third, and fourth portions of the duodenum. The superior mesenteric and inferior pancreatico-duodenal artery and vein cross it towards the left, the vein leading up to the commencement of the portal vein; the superior pancreatico-duodenal vessels cross it towards the right. Inferiorly, it is crossed by the transverse colon and its mesentery. Behind, it rests upon the aorta, inferior vena cava, right crus of the diaphragm, and right renal vessels, and the common bile-duct is usually lodged in a groove in its substance.

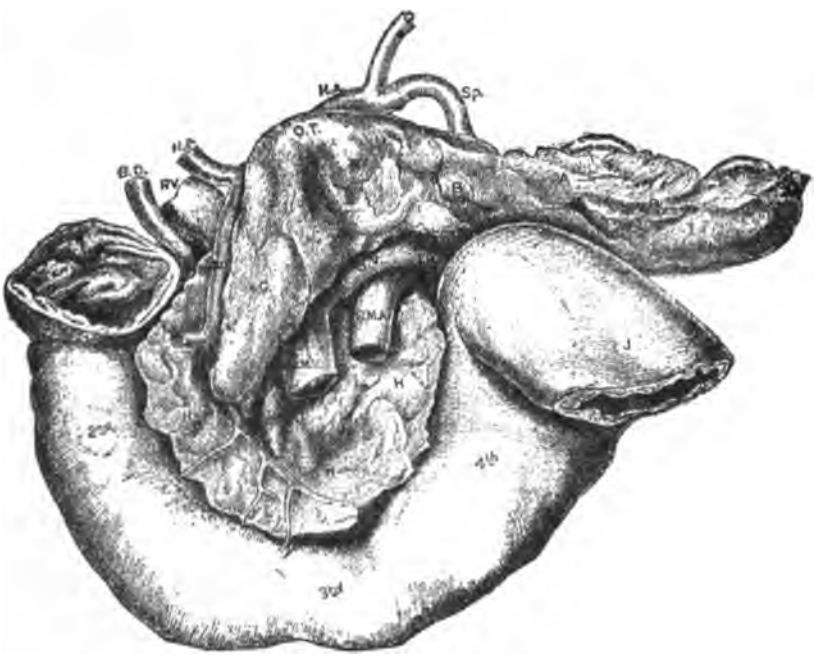

FIG. 322J.—ANTERIOR VIEW OF THE PANCREAS AND DUODENUM. (Symington, Quain.)

H, H, H, head; C, neck; B, B, body of the pancreas; A, I, anterior and inferior surfaces of body; O.T., omental tuberosity; 2nd, 3rd, 4th, second, third, and fourth portions of duodenum; J, jejunum; H.A., G., Sp., hepatic, gastric, and splenic arteries; G.D. and S.P.D., gastro-duodenal and superior pancreatico-duodenal arteries; S.M.A., S.M.V., superior mesenteric artery and vein; S.V., splenic vein; I.M., inferior mesenteric vein; P.V., portal vein: B.D., bile-duct.

The NECK passes upwards, forwards, and to the left from the upper and front part of the head. It is about an inch long. It gets in front of the portal vein and of the termination of the superior mesenteric. In front and above it is grooved by the first portion of the duodenum. Directly to its right are the gastro-duodenal and superior pancreatico-duodenal arteries; to its left is the pylorus, when the stomach is distended.

The BODY turns backwards after crossing the spine and the aorta. It is prismatic, with surfaces – anterior, posterior, and inferior.

The *anterior surface* is large, convex, and prominent to the right, where it presents the omental tuberosity corresponding, as does the omental tuberosity of the liver, to the lesser or gastro-hepatic omentum. Further to the left it is concave, and has the stomach resting upon it.*

The *inferior surface* is narrow,* and rests, to the right, on the duodeno-jejunal flexure; to the left, on the coils of the jejunum and the transverse colon.

The *posterior surface* crosses the aorta, the crura of the diaphragm, the superior mesenteric artery, the left kidney and its vessels, and left suprarenal capsule. The splenic vein courses along its upper part, there receiving the inferior mesenteric vein.

Traced backwards, the two layers of the transverse mesocolon separate at the prominent anterior border of the pancreas, the anterior or upper layer passing over the anterior surface of the organ, and the under or the posterior layer over the under surface.†

The posterior surface is of course uncovered by peritoneum.

The upper border is in relation with the cœliac axis.

The TAIL of the pancreas turns upwards and backwards, and comes in contact with the lower part of the inner aspect of the spleen.

VI.—PORTAL VEIN.

The portal vein is said by recent writers to lie *in front* of the head of the pancreas.

The new way of putting it is simply the expression of views based, not upon the examination of the abdominal organs as seen in the dissecting room, or as exposed,

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* See Professor Birmingham's description (page 132u), which recognises an *upper*, not an anterior surface, and an inferior *as broad as the upper surface*.

† The attachment of the transverse mesocolon to the prominent anterior border of the pancreas is a circumstance throwing a flood of light, to the Author's mind, on the genesis of the surfaces, borders, &c., of the soft visceral structures. We have here the stomach pressing upon the pancreas from above; the colon, jejunal flexure, &c., pressing on it from below. Given the soft, yielding consistence of the pancreas, what *must* be the simply mechanical result? Clearly that the gland come to project forwards between the two areæ of compression, – that the pancreas become, in sagittal section, prismatic, with upper and lower surfaces more or less inclined, and a prominent anterior border. What *must* be the relation of this border to the transverse mesocolon? Clearly that the transverse mesocolon be attached to it. The border results from the projection forwards of the gland-substance in the interval between the two areæ of compression, – *i.e.*, immediately below the stomach, and immediately above the colon, jejunal flexure, &c., *i.e.*, *in the line of attachment*, between these, *of their thin parting plane*, the transverse mesocolon. It will be seen that the view supports Professor Birmingham's description of the pancreas, rather than the one above given.

when surgical reasons present, in the living patient, but based upon the examination of these organs as hardened in the dead body previously to their being got at. The reader will at once see the point if he will compare Figs. 304 and 306 (Tablets pp. 115a & 118a), on the one hand, with Figs. 322J, K, and L, on the other. The former figures represent the soft or natural pancreas as exposed by the simple removal of surrounding structures. The latter figures represent the organ as pressed upon by these surrounding structures, and hardened while so pressed upon.

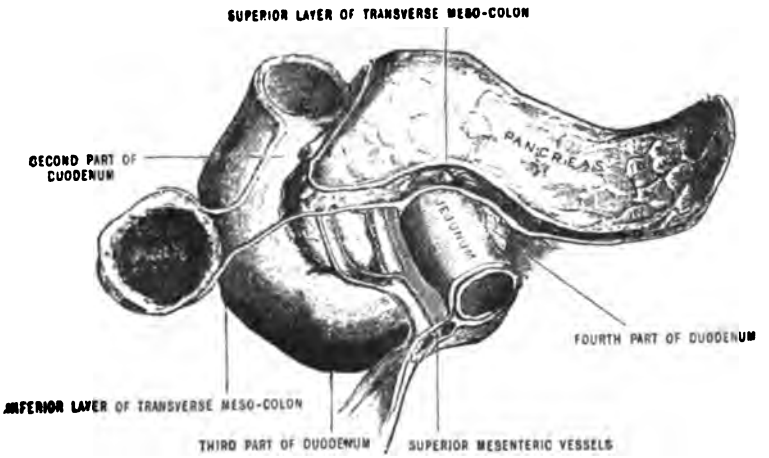

FIG. 322K.—THE PANCREAS AND SURROUNDING STRUCTURES SEEN FROM THE FRONT. (Morris.)

The stomach is, of the several organs of the abdomen, the one which presents the most marked transitions from flaccid emptiness to, at meal times, sudden distention and bulky weight. Of the several neighbouring structures, it is doubtless the soft pancreas, which lies immediately behind the stomach (immediately beneath it in the dorsal recumbent position), that is most affected, in regard to outward shape, by its periodically overcharged and overweighted neighbour. It is clear that it is this mechanical action of the full stomach which, through simple bulkiness, (1) hollows out the anterior or upper surface of the greater part of the body of the pancreas, and (2) drives up a portion of the body and of neighbouring part of the neck behind the lesser omentum, into a region of less disturbance and pressure, – thus forming the omental tuberosity. Then what wonder that a portion of the gland, which, we are told, "tends to overflow its boundary," be driven *behind* the vena portæ? * (Fig. 322L.)

It is this small portion, thus driven behind the portal vein, that advanced anatomists call the "head;" while the remainder of the dissectional head, they call the "neck." The question of the relation of the portal vein thus becomes a mere question of grammar. Dissectionally, the portal vein begins and lies behind the upper part of the head of the pancreas, the term "head" being used in its plain dissectional sense.†

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* See previous reference to the prominent anterior border of the pancreas, page 132n.

† The modern use of the term "head" is not even consistent: The neck is said to pass upwards and to the left from "the front part of the *head*." Now it will be clear that the "*head*" here referred to is not the small portion of the gland buried behind the portal vein, but the large anterior portion, – continuous with the neck, – shown in Fig. 322K, which portion is distinctly seen to lie in front of the superior mesenteric vessels, and consequently *in front* of the portal vein at its commencement.

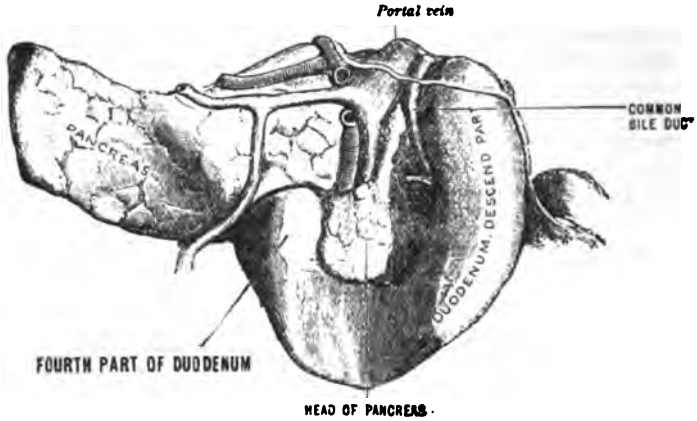

FIG. 322L.—THE PANCREAS AND SURROUNDING STRUCTURES SEEN FROM BEHIND. (Morris.)

The *gastro-phrenic ligament* is a small fold of the peritoneum, and which connects the fundus of the stomach to the under surface of the diaphragm on the left side of the œsophagus.

The *lieno-renal ligament* is a short fold of peritoneum extending from the front of the kidney to the hilum of the spleen, and transmitting the splenic vessels.

Various peritoneal fossæ are described in the neighbourhood of the cæcum, termed Ileo-colic, Ileo-cæcal, and Sub-cæcal. There is also described an Intersigmoid fossa on the under surface of the sigmoid flexure of the colon. Mr. Treves is the British authority on these fossæ.

VI.—SPLEEN.

The spleen forms an irregular and somewhat flattened tetrahedral mass curved round the larger end of the stomach, and presenting two specially prominent features;

FIG. 322M.—PHRENIC OR BASAL SURFACE OF THE SPLEEN. (Morris.)

(1) a broad base, the phrenic or basal surface, formerly called the outer surface, – and (2) a more or less distinct apex lying on the antero-internal, or visceral, aspect (formerly called the inner surface), from which apex there start three *apical* surfaces (so-called from their radiating from, or converging towards, the apex), – these surfaces being the renal, gastric, and pancreatico-colic, and being separated from each other by three *apical* borders, and separated from the phrenic or basal surface by three *basal* borders and three *basal* angles.*

The *phrenic or basal surface* (Fig. 322M) is large and triangular, and bounded by the three basal borders and angles again referred to below. It is convex, being pressed against and moulded into the concavity of the diaphragm. In the greater part of its extent it looks upwards, backwards, and to the left; quite internally and superiorly, it looks upwards and inwards (Symington), since here it rests upon the portion of the diaphragm surmounting the left crus, – that is on the inner wall of the left arch or cupola. The phrenic surface is obliquely crossed by the eighth, ninth, tenth, and eleventh ribs, – the peritoneum and diaphragm intervening, and also, behind these, at the upper part, the left lung and pleura.

The *apex* lies at the lower and back part of the visceral aspect (Fig. 322N). (This apex evidently results from the relative absence of pressure at the point of meeting

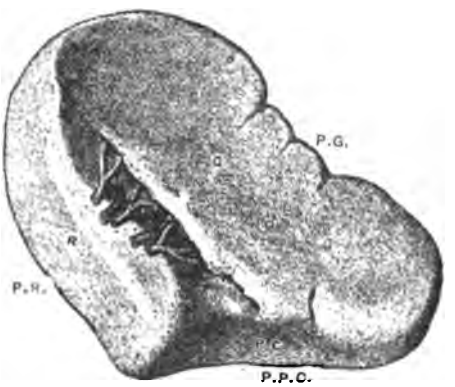

FIG. 322N.—INNER ASPECT OF THE SPLEEN IN AN INFANT FIVE DAYS OLD. (Symington, Quain.)

G, R, B, the three surfaces, gastric, renal, and pancreatico-colic (the latter Professor Cunningham's *basal* surface); the prominent apex is seen at the point of meeting of these surfaces, and from this are seen to radiate the three apical borders. A, P, I, the three basal borders, phreno-gastric, phreno-renal, and phreno-pancreatico-colic, sometimes termed anterior, posterior, and inferior.

of the surrounding solid – or intermittently distended – structures, the kidney, pancreas, stomach, and colon.)

As stated, the apical surfaces, or surfaces radiating from, or converging towards the apex, are the renal, gastric, and pancreatico-colic.

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* The description here given will be found to tally with Prof. Cunningham's, except that it is the phrenic surface that is taken as the base of the tetrahedron, its apex then being Prof. Cunningham's *internal basal angle*. This modification has involved a slightly altered designation of certain other parts.

The *renal surface* (R, Fig. 322n) is long, narrow, and concave. It looks downwards and inwards, being moulded on the outer part of the left kidney. Quite superiorly it touches the suprarenal capsule, and may be slightly indented by it.

The *gastric surface*, G, is deeply excavated, and the largest. It looks forwards and inwards. Posteriorly, and a little in front of the reno-gastric border (see below), is the hilum, a long vertical fissure, or series of foramina, for the entrance and exit of the vessels and nerves.

The *pancreatico-colic surface*, P.C., is more variable than the others, for the reason that is moulded upon those soft and varying structures, the pancreas and the colon, – on the former internally, and on the latter externally, – and on the phreno-colic ligament.

The apical borders radiate from the apex towards the three basal angles, or angles of the phrenic or basal surface, and separate the above-mentioned apical surfaces. They may be termed respectively reno-gastric, reno-pancreatic, and gastro-pancreatico-colic.

The *reno-gastric border* is the longest; it passes upwards and backwards to the highest and innermost part of the spleen, or *superior basal angle*. It separates the renal and gastric surfaces.

The *reno-pancreatic border* is quite short; it passes downwards and backwards to the *posterior basal angle*. It separates the renal and pancreatico-colic surfaces.

The third apical border, the *gastro-pancreatico-colic*, is of intermediate length; it passes downwards and forwards to the *anterior basal angle*. It separates the gastric and pancreatico-colic surfaces.

The three basal borders, which bound the phrenic or basal surface, may be termed phreno-gastric, phreno-renal, and phreno-pancreatico-colic.

The *phreno-gastric border*, P.G., formerly called anterior border, is the longest; it is a sharp border, usually notched in one or two places.

The *phreno-renal border*, P.R., formerly called the posterior border, is thick and rounded.

The *phreno-pancreatico-colic border*, P.P.C., is variable, as is the corresponding pancreatico-colic surface.*

* The foregoing description of the spleen, – practically, as stated, Prof. Cunningham's, – is not accepted by all anatomists, as will be gathered from Morris's figure below given. It will be seen that

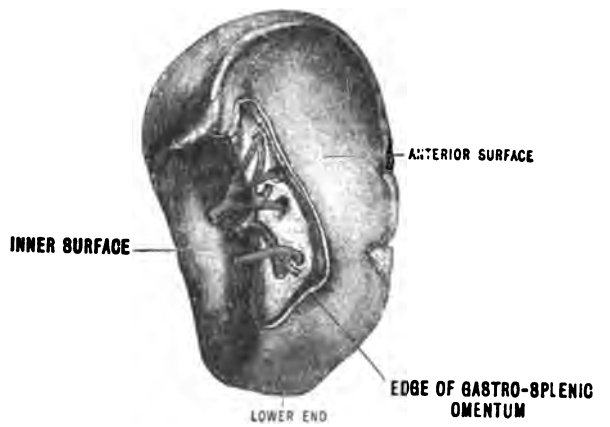

FIG. 322o.—ANTERO-INTERNAL, OR VISCERAL, ASPECT OF THE SPLEEN. (Morris.)

VII.—KIDNEY.

Says a prominent authority (Quain): "The kidney, when hardened *in situ*, presents facets corresponding to the viscera with which it is in contact; and its posterior surfaces may have also slight depressions opposite the last rib, and the transverse processes of the two upper lumbar vertebræ."

Professor Cunningham goes further into details:—

The anterior surface of the kidney is marked out into superior and inferior inclined planes, separated by a distinct transverse prominence which extends more or less on to the outer border of the organ.

On the upper inclined plane of the left kidney there rest the *suprarenal capsule*, *spleen*, *pancreas*, and *stomach*. The suprarenal capsule occupies a narrow area along the upper part of the inner border between the hilum and the summit of the organ. The

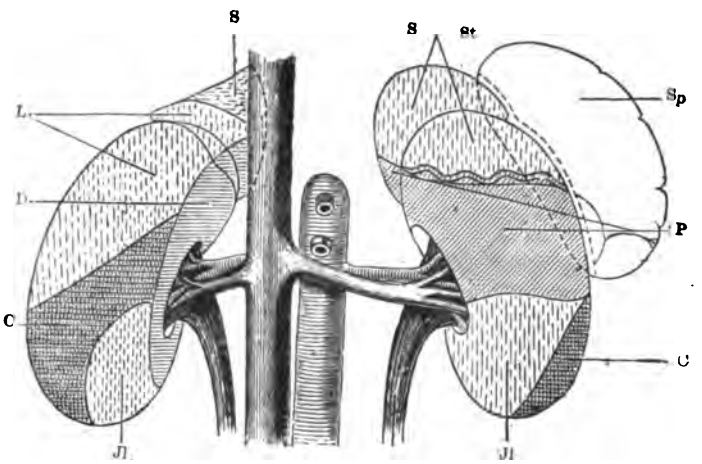

FIG. 322P.—DIAGRAM OF THE ANTERIOR RELATIONS OF THE KIDNEYS. (Morris.)

In both kidneys: S, suprarenal capsule; C, colon; JI, jejuno-ileum. In right kidney: L, liver; D, duodenum. In left kidney: St, stomach; Sp, spleen; P, pancreas.

Morris divides the inner aspect of the spleen into *inner* and *anterior surfaces* only, and that, in this description, the pancreatico-colic surface is simply referred to as the *lower end*. This is conformable with what the Author has usually noticed. (See page 116B.) Prof. Cunningham's descriptions of the spleen and kidney the Author believes to be applicable only to the specially soft structures of childhood (of course hardened or "reconstructed"), which is, indeed, all the corresponding figures are intended to represent,—though the text is widely read as applying to the adult organs.

spleen occupies a very variable area adjoining the outer border. The pancreas stretches over, or a little above, the central prominence. The stomach occupies the remainder of the upper inclined plane.

The lower inclined plane of the left kidney is occupied by the colon, with, perhaps, some coils of the small intestine.

The peritoneal areæ of the left kidney are the gastric, splenic, and the jejuno-ileac.

On the upper inclined plane of the right kidney there rest the *suprarenal capsule* and the *liver*. The suprarenal capsule covers a small area adjacent to the upper extremity. The hepatic area is a large one, corresponding to nearly the upper two-thirds of the kidney.

On the lower inclined plane there rest the hepatic flexure, with the commencement of the transverse colon, and a few coils of the small intestine.

The duodenum occupies a very variable portion of both inclined planes near the inner border of the organ.

The peritoneal areæ of the right kidney are the hepatic and the ileo-colic.

In regard to the posterior surface of both kidneys, see page 132b.

Mr. William Anderson, writing in "Morris's Anatomy," ignores the views on which the above description rests. (See page 152a.)

In the "subject" in the dissecting room, and when reached in the living, the kidney presents none of the markings above described.

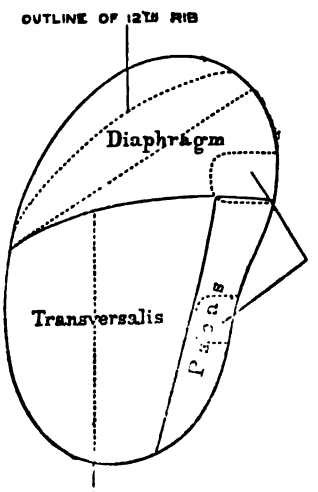

FIG. 322Q.—DIAGRAM OF THE POSTERIOR RELATIONS OF THE KIDNEY. (Morris.)

PROF. BIRMINGHAM'S RESEARCHES.

Prof. Birmingham's researches, supported, as they are, by a most interesting cast roughly sketched on the next page, throw considerable light on various details of the "reconstructed" abdomen. The relations of the pancreas with the kidney, spleen, and transverse mesocolon – as forming part of the stomach-bed and stomach-chamber – are particularly interesting. So is also the Spigelian recess of the diaphragm.

The following is a synopsis of these researches:—

The "Stomach-Bed" and "Stomach-Chamber."

The body of the pancreas presents an extensive *upper* (not anterior) surface, on which the stomach rests.

As the pancreas crosses the kidney, it is so moulded on that organ, that the adjacent upper part of the kidney forms, so to speak, an extension backwards of the upper surface of the pancreas, and of the stomach-bed. The pancreas comes in contact with the spleen, and with the suprarenal capsule, in a very similar manner: the plane of its upper surface is continued, with but slight interruption, on to the concave gastric surface of the spleen, and on to that of the suprarenal capsule. These latter organs complete the bed posteriorly. Further back, the spleen, curving upwards, forms a partial cap for the great end of the stomach. In front, the transverse mesocolon, passing forwards from the prominent anterior border of the pancreas, forms an anterior prolongation of the stomach-bed, supported inferiorly by convolutions of the small intestine. The stomach-chamber is roofed in by the diaphragm and the under surface of the left lobe of the liver. The abdominal wall closes it in anteriorly.

The Body of the Pancreas.

His's model (Fig. 322K), and the description previously given, present the pancreas as flattened against the posterior abdominal wall, and as having anterior and posterior surfaces of considerable extent, and a narrow inferior surface. The pancreas has no true anterior surface, – His's "anterior surface" forming part of the stomach-bed as above described, and looking *almost directly upwards*. The inferior surface of the pancreas is practically as large as the superior. The body of the pancreas projects very markedly into the cavity of the abdomen, and is distinctly prismatic with three nearly equal surfaces. Its anterior border, which gives attachment to the transverse mesocolon,* is specially sharp and prominent.

The upper surface of the pancreas is referred to with the stomach-bed.

Its under surface rests, to the left on the transverse colon, to the right on duodeno-jejunal flexure, and between the two on the coils of the jejunum.

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* See foot-note, p. 132n.

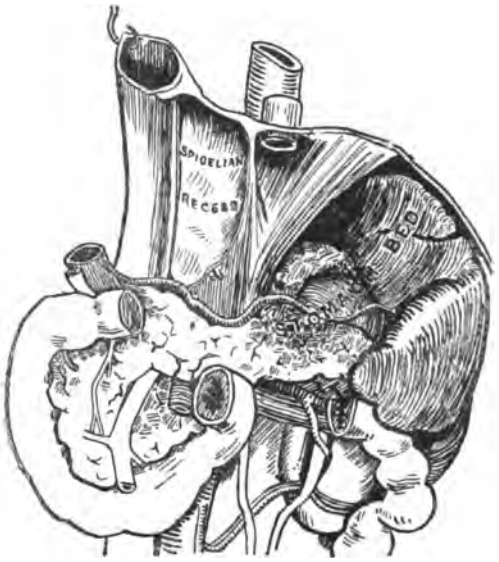

FIG. 322R.—PROF. BIRMINGHAM'S STOMACH-BED AND SPIGELIAN RECESS, AS LOOKED AT FROM IN FRONT AND ABOVE. (From viscera hardened *in situ* in the author's dissecting room.)

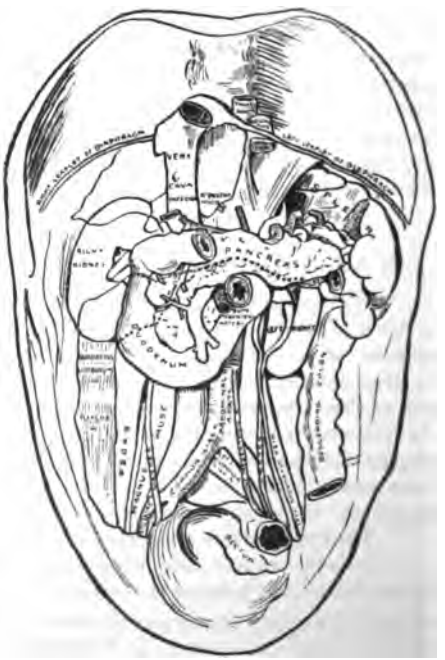

FIG. 322S.—OUTLINE OF PROF. BIRMINGHAM'S CAST, LOCATING THE ABOVE.

Liver.

In regard to the liver, the fissure for the ductus venosus, and the lobus Spigelii differ materially, says Prof. Birmingham, from what is presented in the current descriptions of His and other modern anatomists following that scientist.

The fissure for the ductus venosus is greatly deepened by the folding backward of the left lobe of the liver against the lobus Spigelii. In a horizontal section, this fissure

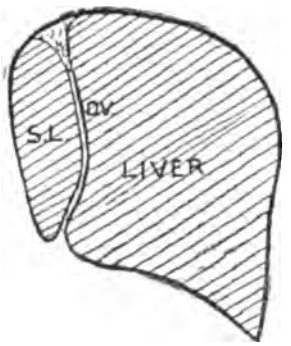

FIG. 322T.—SKETCH OF THE LIVER IN BRAUNE'S PLATE II. (MESIAL SECTION OF FEMALE BODY).

D.V., fissure for ductus venosus; S.L., Spigelian lobe (Birmingham).

is seen to run outwards and to the right for over an inch, and to reach a point about three-quarters of an inch in front of the fissure for the inferior vena cava. The lobus Spigelii

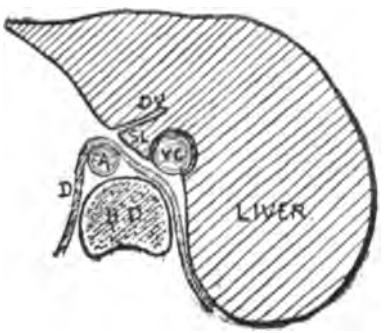

FIG. 322U.—HORIZONTAL SECTION AT THE LEVEL OF THE 11TH DORSAL VERTEBRA. FROM A FROZEN SECTION. (Birmingham.)

A, aorta; D, diaphragm; D.V., fissure for ductus venosus; S.L., Spigelian lobe; V.C., vena cava.

thus becomes, in a horizontal section, a projecting pyramidal mass with three surfaces, one lodged in the Spigelian recess of the diaphragm, one in contact with the inferior vena cava, and one in contact, as explained, with the back of the left lobe.

The Spigelian recess is a deep depression of the diaphragm lined by the peritoneum of the lesser sac, into which the Spigelian lobe fits posteriorly. It is bounded on the right by the inferior vena cava, and on the left by a well-marked ridge of the diaphragm resulting from the œsophagus piercing it above, and from the aorta lying behind it below.

Even in the empty condition of the stomach, the pylorus lies over two centimetres to the *right* of the median plane.

Nearly half the duodenum, including the whole of its descending portion, lies in a plane not far from sagittal. The descending portion of the duodenum lies distinctly on the right side of the vena cava, and not in front of it.

II.

DESCRIPTIONS OF THE ABDOMINAL VISCERA BASED UPON HIS'S PLASTER OF PARIS MODELS.

Except in regard to the Liver, these descriptions are being rapidly superseded by those based on the "reconstruction method," as referred to above. Only the following is retained, therefore, of what appeared on the subject in the previous edition of the Tablets.

Liver

Its large, or so-called transverse, diameter is distinctly inclined backwards and to the left.

The thick end of the right lobe is curved downwards and backwards to the extent that the greatest vertical measurement, or greatest thickness, of the organ is greater than its width from before backwards.

A large part of what has hitherto been described under the surface of the liver looks directly backwards, so that a posterior surface must be described to the organ, and the description of the under surface must be modified.

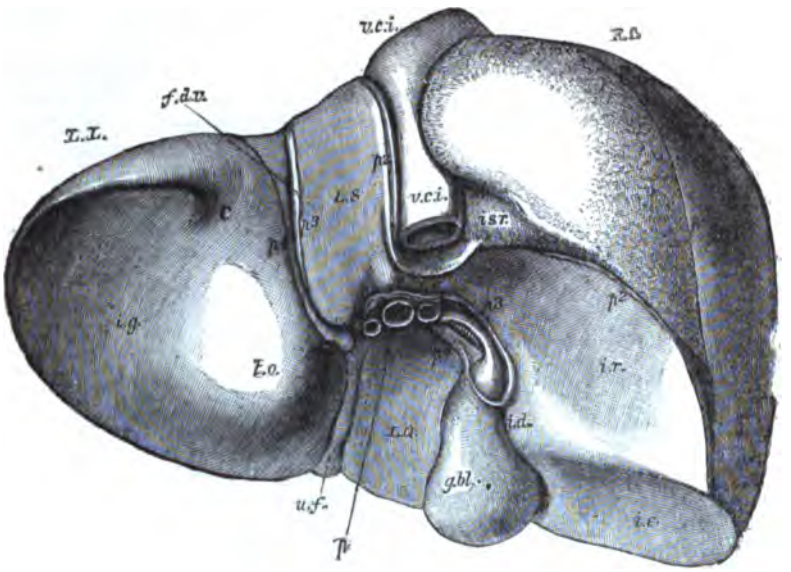

FIG. 322v.—THE LIVER OF A YOUNG SUBJECT, SKETCHED FROM BELOW AND BEHIND.

[The drawing has been made by Mr. Wesley from a cast prepared under the direction of Prof. His, of Leipzig.] (½.) (Quain.)

R.L., right lobe; *L.L.*, left lobe; *L.S.*, lobe of Spigelius; *L.C.*, caudate lobe; *L.Q.*, quadrate lobe; *p.*, portal fissure; *u.f.*, umbilical fissure; *f.d.v.*, fissure of the ductus venosus; *g.bl.*, gall-bladder; *v.c.i.*, vena cava inferior; *i.g.*, impression on the under surface of the left lobe corresponding to the stomach; *C*, position of the cardia; *t.o.*, projection of the posterior surface of the left lobe against the lesser omentum [tuber omentale, His]; *i.c.*, impressio colica; *i.r.*, impressio renalis; *i.sr.*, impression supra-renalis; *p1*, *p2*, *p3*, *p4*, lines of reflection of the peritoneum; *x*, surface of the liver uncovered by peritoneum.

Posterior Surface of the Liver.

Presents a little to the left the *lobus Spigelii* (*L.S.*), which looks backwards and inwards, and rests upon the right crus of the diaphragm.

Superiorly this lobe is rounded off, and continuous with the upper surface of the right lobe; inferiorly it somewhat overhangs the transverse fissure internally, and is continued externally into the *lobus caudatus* (*L.C.*), which joins the remainder of the right lobe. To the right it is bounded by the *fissure for the inferior vena cava* (*v.c.i.*); to the left by the *fissure for the ductus venosus* (*f.d.v.*).

To the left of the lobus Spigelii and of the fissure for the ductus venosus, there are seen from above downwards the *œsophageal grove* lodging the œsophagus, a *depression corresponding to the cardia* (*C*), and the large *omental tuberosity* (*t.o.*) (sometimes described as

belonging to the under surface),* which rests on the omental tuberosity of the pancreas, the lesser omentum intervening.

On the right side of the lobus Spigelii there are seen first the *groove for the inferior vena cava* (*r.c.i.*), and then a *broad and convex strip of the right lobe* uncovered by peritoneum (*x*), and adherent to the diaphragm by firm areolar tissue, which was formerly described as belonging to the posterior border. This strip slightly overlaps the inferior vena cava, and presents below and internally a slight depression, the *impressio supra-renalis* (*i.s.r.*), corresponding to the supra-renal capsule.

The posterior surface of the liver is concave from side to side; it embraces the bodies of the vertebræ a little to the left of its middle.

Under Surface of the Liver.

Now comprises only:—

1 – As regards the right lobe, that portion of what used to be called the under surface of that lobe which is anterior to the transverse fissure. This portion of the organ is divided in two by the fissure or fossa of the gall-bladder (*g bl.*).

On the right side of the gall-bladder is seen in front the *impressio colica* (*i.c.*) for the hepatic flexure of the colon, and behind this the *impressio renalis* (*i.r.*) for the right kidney, internally to which latter, and close to the neck of the gall-bladder, is the small *impressio duodenalis* (*i.d.*) corresponding to the junction of the first and second portions of the duodenum.

On the left side of the gall-bladder is the *quadrate lobe* (*L.Q.*), quadrangular in shape, and broadest from before backwards, which overlies the pyloric end of the stomach and the commencement of the duodenum, and is concave, through the pressure of these parts (the latter being distended).

2 – As regards the left lobe, little more than the left half, and the anterior marginal portion of the right half, of what has hitherto been described as the under surface of this lobe, – these parts being markedly concave, and moulded, the former on the cardiac end of the stomach (distended) (impressio gastrica, *i.g.*), and the latter on that part of the anterior surface of the stomach which lies nearest to the lesser curvature.

N.B. – The lower part of the lobus Spigelii, the lobus caudatus, and the omental tuberosity might still be described, even on the plaster of Paris models, as belonging to the under surface of the organ.

The following illustrations of His's models may be referred to as conformable, in the main, with the records obtained through the "reconstruction method," and therefore still substantially up to date.

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*Usually nothing of all this can be seen on the liver as removed from the anatomical subject in the ordinary course of dissection. To follow the above description, the student should have His's plaster of Paris models before him.

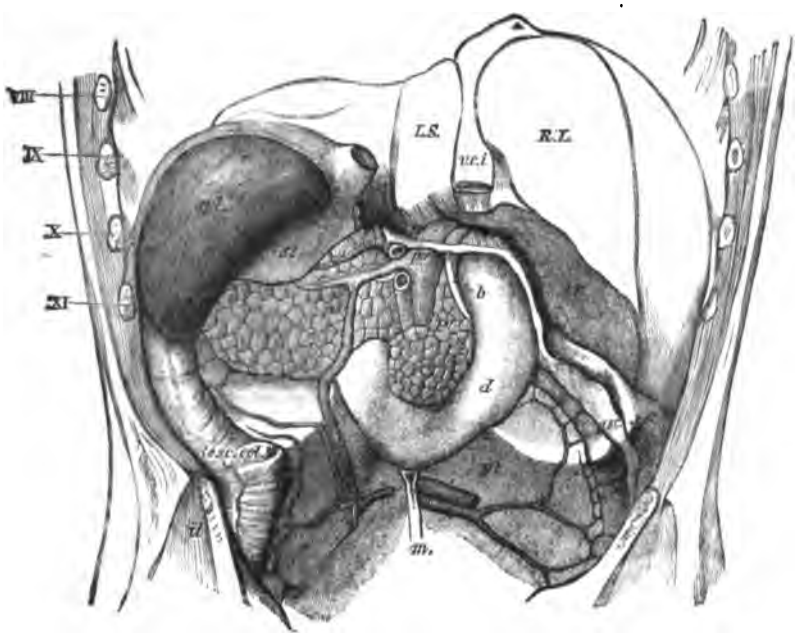

FIG. 322X.—VIEW OF THE ABDOMINAL VISCERA FROM BEHIND, AFTER REMOVAL OF THE SPINAL COLUMN AND THE WHOLE OF THE POSTERIOR WALL OF THE ABDOMEN, THE PERITONEUM BEING LEFT. (Quain.)

P., pancreas; *P'.*, its head; *d.*, duodenum; *st.*, stomach; *spl.*, spleen; *R.L.*, right lobe of the liver; *L.S.*, Spigelian lobe; *v.c.i.*, vena cava inferior; *p.r.*, portal vein; *b.*, common bile duct; *i.r.*, impression from the right kidney on the posterior surface of the liver—the situation of the two kidneys is well shown by the corresponding impressions in the cast; *asc. col.*, *desc. col.*, ascending and descending colon; *pt.*, back of the peritoneum; *m.*, line of reflection of the mesentery seen through; *VIII.*, *IX.*, *X.*, *XI.*, the corresponding ribs; *il.*, ileum.

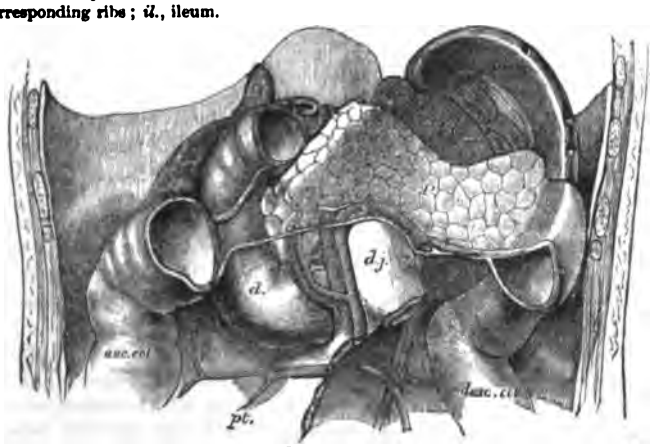

FIG. 322Y.— PANCREAS AND ADJOINING VISCERA FROM BEFORE. (½.) (Quain.)

The stomach, the greater part of the small intestine, and the transverse colon have been removed.

P., pancreas; *d.*, duodenum; *d.j.*, its junction with the jejunum; above the duodenum, and between it and the head of the pancreas, are seen the bile duct, portal vein, and hepatic artery; *asc. col*, *desc. col*, ascending and descending colon; *spl.*, spleen; *r.k.*, *l.k.*, right and left kidney; *s.r.*, *s.r'.*, right and left suprarenal capsules; *p.t.*, peritoneum at the back of the abdominal cavity; *m.*, line of reflection of the mesentery; the line of reflection of the transverse mesocolon is seen along the lower edge of the pancreas and crossing the duodenum.

Meckel's Diverticulum.

Is a blind pouch occasionally found on the free margin of the small intestine from one to three feet above the termination of the ileum. It is the remains of the omphalo-mesenteric duct (See page 132ii).

Pyloric Vein.

Under the above name Mr. Walsham describes what is practically a second gastric vein. It is a small vein running from left to right along a small portion of the lesser curvature of the stomach near the pylorus, and opening into the trunk of the portal vein.

REMARKS (1894):—

His's models represent the condition of the internal organs, as seen in a supposed typical case - that of a healthy young man, who died an accidental death *shortly after a full meal*. The models are casts of the viscera as examined *in situ*, in the *frozen condition*, in this particular case.

On examination of these models, three things strike one: - (1) the extremely distended condition of all the hollow viscera, - the stomach, for example, is of the shape of an inflated bagpipe; (2) the extent to which these distended viscera, stomach, duodenum, &c. (the distention being explained by the full meal), have pressed upon and indented the surrounding soft structures; and (3) the extent to which the several other viscera (physiologically congested?) have pressed upon and indented each other. The models, though no doubt accurate representations of what was found in the particular instance above referred to, cannot be considered to represent the condition of things which usually pertains. They certainly do not represent the conditions observable either in the anatomical subject or in the living patient, when, for surgical purposes, the visceral cavities have to be opened and their contents exposed. Thus, when gastrostomy is called for, as in œsophagal cancer, the stomach is found collapsed and retracted beneath the lower ribs, - not distended. Though these models may serve to slightly correct certain statements as to levels, &c., it is a fatal mistake, to the Author's thinking, to attempt to re-describe the internal organs in accordance with, and to invite students to learn their anatomy from, them. The old familiar descriptions, - descriptions of what is actually seen and handled in the anatomical "subject," - which is incomparably the nearest approach to the living body, - cannot be upset by such unrealities. In the Tablets, the old descriptions are left standing, with just a few minor corrections. The above notes on the new descriptions, referred to *in so far as they differ from the old ones*, are simply added as a kind of appendix.

III.

"DISSECTIONAL," "RECONSTRUCTED," AND "LIVING" FORMS.

Discussion must now be permitted.

Short designations facilitate clear statement. No objection will be raised to the above terms as applied to the configuration of the internal - more particularly the abdominal - organs, as studied [1] in the natural or non-hardened condition, as in the dissecting room, [2] as hardened *in situ* prior to removal, and [3] as supposed to exist in the living body, of course out of reach and out of sight except when a surgical operation is required.

The "living" forms are modified from hour to hour. This goes without saying in regard to the hollow viscera; and is shown, in regard to the solid viscera (so-called solid viscera; they are really *soft* and *yielding masses*) by the examination of the "reconstructed" forms as taken under varying conditions; so much so that, writes Professor Cunningham, "*It is impossible to state the* AVERAGE *condition of the various organs and viscera.*" Quite irrespectively, indeed, of pathological conditions, or of such conditions as may result from tight lacing or the like, casts of either pancreas, spleen, or liver are seen to differ about as much, - and, inferentially, successive casts (hypothetical) of the same identical viscus, - as, if one may so put it, any two apples on a tree, or any two dogs in a dog show.* (Compare Prof. Cunningham's Figures 100, 101, 103, 104, 123, 127.) As for the hollow viscera, Braune's sections show that they have no more settled shape of their own than a pocket-handkerchief crumpled up in the pocket.

Further, even presuming the "living" forms to be definable in the abstract, they are, *ex hypothesi*, modified as soon as the organs are exposed, as in a surgical operation. They are modified by the very fact of the incision into the abdominal wall, let alone the introduction of the surgeon's hand.

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* The comparisons are apt and congruous, and will therefore be excused.

The Author has made just a few hardenings, and believes that even the relative uniformity generally obtained is largely due to what has always appeared to him exaggerated care as to the similarity of the conditions under which the subjects are hardened. The Author has before him a monograph on visceral hardening by a leading anatomist, in which several pages are devoted to the question of the *attitude* (sitting, or dorsal, ventral, or lateral decubitus) in which the subject should be placed when operated on - in order that the *correct* (?) result be obtained.

The foot-note, page 132n, would go a long way to show that the shape of at least the softer organs is so directly governed by the conditions pertaining to the hollow viscera as to be a *predictable* result of the mechanical conditions which exist. Under like conditions as to position, meals, &c., forms closely corresponding must thus develop as a matter of course. But what does the thing really come to What character attaches to a colic impression on the liver or kidney, to a gastric or renal impression on the spleen, or to a costal or arcuate furrow on the kidney, - *to make these a part of the describable anatomy of the corresponding organs*, - which does not pertain to the mutual palmar impressions due to the grasp of two friendly hands? All are *equally* the result of similar action and reaction, contingent and transitory, and therefore, in a true sense, accidental. "It is impossible to state the average condition of the viscera." Quite so; that is precisely what is contended for. It is as impossible, - and were it possible, it would be as useless, - to describe the *exact* shape of an organ at a given time, as to describe the *exact* shape of the palm of the hand when grasped as above. Can one *freeze or in some other way permanise the mark of friendship*, so as to record and measure exactly the extent and depth of the same? (Would that this could sometimes be done in another sense!)

Also, the ordinary student can learn nothing of them by his own personal work and observation. Thus the medical practitioner can know nothing of them in the true and useful sense of knowing.

We, the anatomists (surgical anatomists), - and even the Examiners, - can generally know nothing of them, beyond what a few scientists, - whom one might almost count on the fingers of one hand, - tell us in books, and show (?) in pictures and models.

On views respecting these forms there is based a conception of operative surgery altogether at variance with recognised surgical practice.

The position here taken up is a serious one. It is one the correctness, or otherwise, of which it is a matter so important to settle, that the Author will doubtless be allowed to quote from correspondence in the *Lancet* with a well-known and universally respected authority.

"THE TEACHING OF ANATOMY—ITS AIMS AND METHODS."

(Extracts from letters to the *Lancet* for November 4th and 25th, 1893.)

"SIRS,"

"While honoured by the criticism, by no means unkindly, of perhaps the greatest of British Anatomists, I feel bound, at the present serious juncture in educational matters, to at least call attention to what I consider some errors of doctrine of our leading anatomical scientist."

"I will compress in syllogistic form the teaching which more specially appears to me to be wrong. Says Professor ———— : (1) 'Anatomy should enable the surgeon, without hesitation, to put his finger upon, or a needle into, any structure of the body; (2) the relations of the undisturbed parts are the essence of surgical anatomy; (3) the study of frozen sections is the only way of learning relations.' These views hold so closely together that, if the first be correct, all three must be; and they are, moreover, so plausible that, even if stated by one of less authority, they would carry conviction to most minds almost without investigation."

"The conception put forth by Professor ———— is not new. It is substantially the same—popular errors are long lived—as that with which I was familiar as a student in Paris—that, to the surgeon, the body (to use the metaphor of the day) should be, so to speak, like glass, ransparent, and that the surgeon should see his way through its various structures much as the somnambulist sees his way in what most people call darkness. 'The skin,' says Professor ————, 'should oppose no obstacle to the precision of this localisation;' and, by way of illustration, the example is referred to of a celebrated anatomist who used, blindfolded, to cut down upon and tie the femoral artery. Though without experience as to tying this particular artery blindfolded, I have this day repeated the procedure quite easily in the space of three minutes."

"This is to me but a single instance. But what is no single instance to me is the ligature, under similar conditions, of the subclavian artery, which most surgeons would consider a more difficult artery to tie than the femoral. This artery I have tied a score of times, blindfolded, and would undertake to tie at any time without in any way seeing the subject."

"I submit my experience, not with a view to any personal boasting, but as a first step towards showing that Professor ————'s views with regard to surgical anatomy are incorrect and exploded."

"Professor ———— admits that 'the power of visualising things and places is not given to all men.' I would venture to submit that such power is given to no man."

"It is by a process altogether different that the surgeon seeks and finds the femoral artery, or the subclavian artery, or any other artery or structure whatsoever. The surgeon by no means makes *directly* for any deep-seated structure. It is by means of successive guide- or rallying-points, or *points jalons*, as they were first called by the French anatomists (surgical anatomists), that the surgeon finds his way through the body to this structure or that. If there is one thing of all others that the teacher of operative surgery distinctly impresses upon the young operator, it is that he should not be in any hurry, or at all anxious, to come upon the structure, artery, nerve, or what it may be that he is seeking; that he should be careful of, and fix his mind on one thing only—namely, finding and making quite sure of the several successive guide- or rallying-points on his way. The position of the operator looking for a deep-

seated structure is, in fact, much like that of the legendary explorer lost in a dark cave, whose only means of reaching daylight is his *fil conducteur;* it is much like the position of everyone of us in this London of ours when overtaken by a thick fog while crossing a square, and within perhaps a few yards of our own door, in which case we are guided home by a familiar tree or lamp-post."

"The position taken up by Professor ——— involves quite truly the view that it is the relations of the *undisturbed—i.e., undissected*—parts, not of the dissected or disturbed parts, that the surgeon should study; and involves further the view that anatomy can only be studied to advantage by processes, such as freezing, which do not disturb the relations of the parts. 'The study of frozen sections is the only way to learn relations.' It is but some twenty years ago that frozen sections were first heard of. Were anatomical relations but imperfectly understood by Callender, Fergusson, Wood—to name only British surgeons who are no longer with us? I fear it is fact that Professor ——— is wrong as to his premises, and therefore wrong also as to his conclusions."

"To refer, for the purpose named, to the *modus operandi*, with which, as above stated, I am familiar—that of tying the subclavian artery blindfolded, I would put the thing briefly as follows:—(It will be seen that one is guided throughout by what I have called the *de fil en aiguille principle*, as applied to the sense of touch.) Feel for the clavicle, and for the hollow above it: the boundaries of this hollow will give you the position of the sterno-mastoid, on the one hand, and of the trapezius, on the other; make your incision between these limits. How deep should your incision be? Think for a moment, and you will soon answer the question yourself. The sense of touch, which has guided you as to the position of the incision, will guide you as to its depth—that is, of course, if you are a practical, and not merely a theoretical anatomist. Cut till you find you have reached loose soft tissue. This direction is the rendering in practical terms—in terms of finger-sensation—of the direction, Divide the platysma and the deep fascia. You have now divided the skin, superficial fascia, platysma, and deep fascia; and you find yourself, as above stated, in the loose, soft, connective tissue of the posterior triangle of the neck. Now work your way downwards and inwards, feeling for the scalenus anticus. This muscle will present itself to you in the shape of a somewhat tense and elastic cord about the size of the outer edge of your little finger. It is a structure you cannot miss if you are digitally familiar with the part. Having found the scalenus anticus, get your finger on its poterior aspect, and run your finger down till you are in the angle—an angle of some sixty degrees—between the scalenus anticus and the first rib; there, rolling under your finger on the hard surface of the rib, you will find the artery, quite plain, and easy to 'pick up.' If your finger is properly educated, you cannot possibly take a nerve instead."

In the foregoing *manuel operatoire* I have laid stress upon tactile sensations. I cannot here dilate upon the view submitted; but I would like to put it tersely that the surgeon should have an eye at the tip of his finger. He is of no good as an operator if he has not. In all operations on the deeper parts the *digital* eye is the more important of the two.

"I should like to remark before leaving the subject that Professor ——— does not quote me fully enough to be what I should call quite fair. He admits that I am right as to the first part of the statement which he criticises. But he does not give the second part of my sentence. My sentence, as a whole, read: 'The models (His's models) do not correspond with what we see either in the dissected subject *or in the living patient* when, for surgical purposes, the visceral cavities are opened and the organs exposed.' Will Professor ——— deny that I am right as to my second point also? As soon as the abdomen is opened the parts are, *ipso facto*, disturbed. If Professor ——— does not deny this—as, in fact, he cannot—what becomes, from a practical point of view, of his fundamental contention that the organs must be studied in the undisturbed condition? The fact is that there is no such thing as an undisturbed condition of the visceral organs. They are soft yielding structures whose smooth peritoneal covering is intended to allow of their incessant displacement one upon another, and of their constant adaptation in shape one to the other. The varying conditions of stomach, bladder, intestine, and spleen, each acting upon every neighbouring viscus, have only to be referred to in condemnation of the view of an undisturbed, or, in other terms, fixed, condition of the viscera."

"Professor ——— admits that less attention is now given to dissecting than formerly. What does this mean but that a kind of anatomy less useful than what we formerly had has come to the front *pari passu* with embryology and morphology? These sciences do not help men to learn the *technique* upon which practice rests. . . . . One must found one's anatomy either on the facts of the dissecting room, or on embryology and morphology—on what is visible and tangible—or on what is not so. In the former case one gets a practical knowledge of anatomy—the anatomy familiar to the eye and finger; in the latter case one gets anatomy as a mental conception. In the former case one gets the anatomy of the surgeon; in the latter case one gets the anatomy of the scientist. The two things are absolutely distinct."

"I am, Sirs, yours truly,

"THOMAS COOKE."

(These letters were not replied to.)

132ff

IV.

QUOTATIONS FROM STANDARD AUTHORS.

"In its simplest form, the peritoneum differs in no essential respect from the pleura, the pericardium, the tunica vaginalis. . . . . Imagine the pleural cavity from which the lung has vanished. The membrane would appear as a simple serous sac. Now conceive the lung gradually budding out into this sac. When the lung had attained to nearly the dimensions of the cavity, ... it would still remain outside it. . . . . Imagine the viscera to have vanished from the abdominal cavity, &c. . . . . ."

"Imagine all the viscera of the abdomen in their proper positions, but uninvested by peritoneum. On the top of them is placed a large closed sac, ... and wherever there is a cleft, ... a part (of the closed sac) . . . . is tucked in, &c."

"If the upper part of the abdomen be occupied by a cuboidal mass divided into two by a cut passing from its upper left edge to its lower right one, the position and shape of the liver will be represented by the upper and right half of the mass."

Is it not plain that the aim of the new school is largely to "*explain*," and to get men, as the phrase goes, to "*understand*" anatomy? In so doing, as already stated, the new school often explains away what is useful, and, for facts, substitutes abstract and one-sided conceptions. It is again submitted that *in the anatomy for medical men*, seeing and doing are understanding, and that nothing else is.

V.

THE FORAMEN OF WINSLOW;

BEING A CONFAB. BETWEEN CANDIDATES FOR THE F.-SHIP.*

PERSONÆ: *Two Candidates for the Fellowship,—one a M.D., Lond., 1st Class Honours, Gold Medallist, &c., from leading Metropolitan School;—the other a M.R.C.S. in General Practice in the Country.*

— M.D., Lond., 1st Class Honours, Gold Medallist.—"Do you understand, old chappie, about the foramen of Winslow?"

— M.R.C.S., in gen. pract.—"Well, I think so. It was shown us, dissected, the other day; I put my finger in."

— M.D., Lond., 1st Class Hons., Gld. Med.—"That's not what's wanted. How's it formed?"

— M.R.C.S., &c.—"How it's formed? Well, in front you've got the hepatic artery, bile-duct, port . . . ."

— M.D., &c. (*interrupting*)—"Oh, that's nothing to do with it. How's it formed? How did it come about?"

— M.R.C.S.—"I don't know what you mean."

— M.D., &c.—"Come on, old fellow, I'll put you up to it. Look here; here's a towel."

— M.R.C S., &c.—"Well?"

— M.D., &c. (*manipulating the towel*).—"See how I fold it. Now that's the stomach. You see it's attached to the anterior wall of the abdomen by that bit there; that's the anterior mesentery. Well, the

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* It is hoped that a little *serious badinage* will once more be pardoned.

liver gets formed in there somehow. And the stomach 's first like this, straight, you see. Then it gets bent up in this way. Then it twists round, so. And that's how the foramen of Winslow comes about. That's the thing to tell 'em!"

— M.R.C.S., &c.—"Well, thank you; it's very nice, indeed; all from the newest morphology book, I suppose? But tell me, What have you *really* got in front of the foramen of Winslow? What have you got on your finger when you 've put it in?"

— M.D., &c.—"Oh, I know nothing about that."

— M.R.C.S., &c.—"What have you got behind it?"

— M.D., &c.—"Oh, that's all damned nonsense."

— M.R.C.S., &c.—"What have you got above it?"

— M.D., &c.—"Rubbish. Shut up! shut up!"

The above is an authentic colloquy. It took place in the Author's dissecting room on March 26th, 1897.

Prof. Struthers has "little faith" in the "lists of Class Honours," by which are meant, it is presumed, the pass-lists of the so-called higher examinations. No more has the Author. His experience is that prowess at some of the higher examinations is now little more than an index of a man's power to "cram," and that passing these examinations now-a-days rather stamps a man as probably ignorant, *though clever*, than as really capable. To the Author's mind, men, taken all round, have more practical knowledge at the more ordinary, than at the Honours' examinations. They drop their practical work from the one to the other. Indeed, what they may remember of it is largely driven out of them by the kind of work they *think* they are expected to do. That they think wrongly goes without saying, as is explained elsewhere. But that the unfortunate belief is a reality, there can be no doubt. Nor can there be any doubt that it is generated and kept up by *occasional* unfortunate questions, - asked quite incidentally, it is true, and to which the Examiners attribute but little or no importance; but which the candidate, if he fails to answer them, and to get through, takes as representing what the Examiners really wanted. Thus are spread erroneous views fatal to honest educational work.

It is now-a-days by no means an unrecognised practice to take a few plates and a book, and to read all about, say, the liver, almost without looking at the organ itself, with the result of one's being able to talk learnedly about it, but without . . . well, one would hardly like to say without recognising *the liver* when one sees it . . . but, for the sharply characterised liver, substitute, say, the less defined pancreas or the parotid gland, and it is submitted that the interrupted sentence might be completed as suggested without much fear of contradiction. There are now described to the parotid gland by some anatomists lobes *carotid, pterygoid, glenoid,* &c. Are there not a good many who could correctly recite the received description of the above lobes, who, on seeing a portion of the parotid gland exposed, as in ligaturing the external carotid, would be quite likely to take it, as the Author has seen done, for subcutaneous or inter-muscular fat?

The Author would here repeat, and he trusts he may repeat it till the view is again current, that the only kind of knowledge of the human body that is of any use to the medical man is that acquired from the "subject" by dissecting; and in this connection he would submit that the only kind of statement on the part of the teacher which can lead to the acquisition of such kind of knowledge on the part of the student,

is that in which the teacher describes to the student what he and student can *both* see and handle and can see and handle *equally well*, as far as the outward equation is concerned. Any statement of teacher or text-book going beyond this is an invitation to the student to learn his anatomy by rote or by cram, and as *paper anatomy* as opposed to dissectional anatomy. If it is a desirable part of the student's curriculum that he should study the internal organs as hardened previously to removal, then he should have the means given him of so hardening the same, and it should be seen that he does this kind of work in an honest and efficient manner. If, on the other hand, the cost of such kind of work, in material, time, and money, is out of proportion, as is submitted that it is, with the benefits it may lead to, then the subject should be dropped, at least as far as text-book teaching, and examining, are concerned.

The view embodied in the phrase "*paper anatomy*" will be found developed in Vol. III., pp. 152t to 152w.

DEVELOPMENT OF THE ABDOMINAL DIGESTIVE TRACT AND PERITONEUM.

The differentiation of the several parts of the abdominal digestive tract, and of the corresponding portion of the cœlom, or general pleuro-peritoneal cavity, begins with the differentiation of the stomach and mesentery.

The stomach is at first but the upper part of the primitively straight alimentary tube. It soon presents convex posterior, and concave anterior, borders (Fig. 322z). The former border, or future greater curvature, is attached to the posterior abdominal wall by the upper part of the dorsal mesentery or mesogastrium, in which are the rudiments of the spleen and pancreas. The latter border, or future lesser curvature, is attached to the anterior abdominal wall by a similar antero-median septum, the superior ventral mesentery (Macalister), in which are the rudiments of the liver.

The posterior mesentery, the mesentery proper, or more simply the mesentery, as it will henceforth be termed, results from the thinning out of the mesoblastic tissue between the alimentary canal and the vertebral column. It first constitutes a narrow antero-posterior septum along the posterior aspect of the whole of the alimentary tube. It contains the aorta and its branches to the viscera.

The short portion of the alimentary tube which follows the stomach, – the future duodenum, – is tilted away superiorly from the vertebral column by the incurvation of the stomach, but inclines backwards inferiorly towards the spine; it presents a small mesentery, the mesoduodenum.

The duodenal loop is followed – tracing the intestinal tube caudalwards – by a

much larger U-shaped loop, which develops into the remaining portion of the alimentary canal, the terminal portion of the rectum excepted.

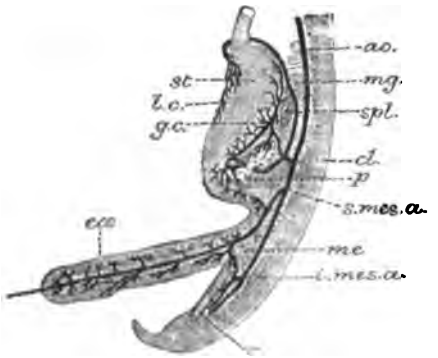


FIG. 322x.—DIAGRAM OF THE MESENTERY, STOMACH, AND INTESTINE OF THE HUMAN EMBRYO OF SIX WEEKS. (Toldt.)

st., stomach; *g.c.*, greater curvature; *l.c.*, smaller curvature; *mg.*, mesogastrium; *spl.*, spleen; *p.*, pancreas; *cæ.*, cæcum; *r.*, rectum; *me.*, mesentery; *ao.*, aorta; *cl.*, cœliac axis; *s.mes.a.*, *i.mes.a.*, superior and inferior mesenteric arteries.

This U-shapsd loop is drawn downwards and forwards towards the umbilicus, where the canal of the intestine passes into the omphalo-mesenteric or vitelline duct. The antero-superior limb of the U-shaped loop, and the neighbouring portion of the postero-inferior limb, become the jejunum and ileum, – the situation of the bend being marked for a time, sometimes throughout life, - by a pouch, Meckel's diverticulum, the remains of the omphalo-mesenteric duct. The upper or vertebral portion of its postero-inferior limb becomes the large intestine, – all but the terminal portion or rectum, which never presents any mesentery.

The differentiation of the large intestine begins by the evagination of the cœcal pouch, a tapering diverticulum, of which, after birth, the conical end contracts into the appendix vermiformis (Figs. 132AA and BB).

The small intestine lengthens out into complex coils, and, with the corresponding frills of its mesentery, comes to fill the space within the horse-shoe of the colon referred to further on.

The mesentery does not long remain the simple mesial septum above described. Its rapidly increasing complications, which result in the intricacies of the adult peritoneum, have, for many years past, formed a field for earnest enquiry in reference to which scientists have ranged themselves into two schools, that of His and Hertwig in Germany, and that of Bland Sutton and Treves in this country.

The evolution of the peritoneum results from :—

I. The displacement, as described below, of the stomach, duodenum and large intestine; and

II. Either (*a*) from adhesions of previously free peritoneal surfaces thus brought into contact with each other (Hertwig, His), or else (*b*) from "the growth of the peritoneum not keeping pace with that of the structures it covers, so that, through the increasing demands upon this membrane of the more rapidly growing viscera, these come, after a time, to be clothed at the expense of those of slower growth." (Treves, in Morris' Anatomy.)

I – The position of the stomach undergoes the following changes: [*a*] It turns over to the right, – the pylorus being raised somewhat, so that the lesser curvature becomes all but horizontal* (Figs. 322AA & BB). [*b*] The greater curvature pivots forward so as to become a lower or anterior, instead of a posterior, border, – the mesogastrium correspondingly elongating. The right, now posterior, surface of the stomach thus comes to rest on the portion of the mesogastrium containing the spleen and pancreas, this portion of the mesogastrium forming the posterior boundary, while the remainder of the mesogastrium forms the lower and left boundaries of the now developing lesser or omental sac of the peritoneum further referred to later on.

The stomach carries the duodenum with it.

The colon, after lengthening somewhat, undergoes a corresponding displacement (Figs. 322AA & BB). Its commencement moves to the right, to a point just below the liver, –

Fig. 7.

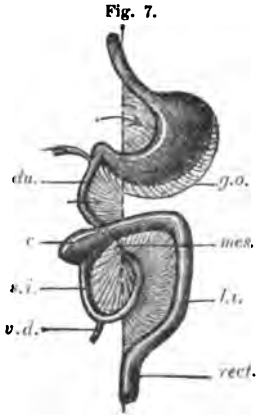
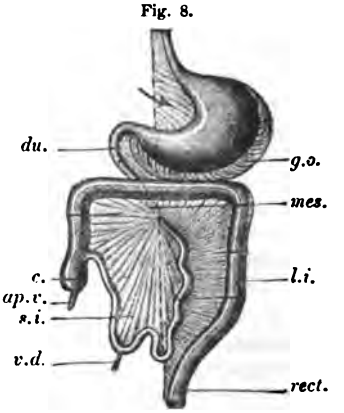


Fig. 8.



FIGS. 322AA & BB.—DIAGRAMS OF THE DEVELOPMENT OF THE HUMAN ALIMENTARY CANAL AND ITS MESENTERY: A, earlier; B, later condition.

g.o., greater omentum, which is developed from the mesogastrium—the arrow indicates the entrance to the omental sac; *du.*, duodenum; *mes.*, mesentery; *s.i.*, small intestine; *l.i.*, large intestine; *rect.*, rectum; *v.d.*, vitelline duct; *c.*, cæcum; *ap.v.*, appendix vermiformis.

carrying, of course, its mesentery with it, – this mesentery elongating, as in the case of the

* The right and left pneumogastric nerves thus come to supply, the former the posterior surface of the stomach, and the latter the anterior surface.

mesogastrium. The commencement of the colon thus lays itself, with its mesentery, over, or in front of, or ventral to, the duodenum. The terminal portion of the colon similarly moves to the left.

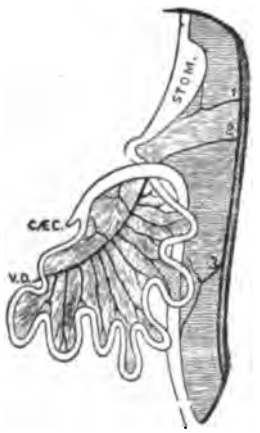


FIG. 322CC.—DIAGRAM TO SHOW THE ROTATION OF THE INTESTINAL CANAL. (Treves, Morris.)

The displacement of the intestine above referred to is described by Mr. Treves as being due to the rotation of the intestine and mesentery round the line of the superior mesenteric artery. By this rotation the superior mesenteric artery is brought to lie behind the transverse colon and in front of the duodenum, and to give off the vasa intestini tenuis from its *left* side, and the principal colic arteries from its *right* side. The morphological termination of the superior mesenteric artery is at Meckel's diverticulum.

At this time the large intestine consists of cæcum, transverse colon, descending colon, sigmoid flexure and rectum. There is as yet no ascending colon. This is formed by the extension downwards of the commencement of the large intestine (Fig. 322BB), by which the cæcum descends from below the liver to its final position in the right iliac fossa.

II.

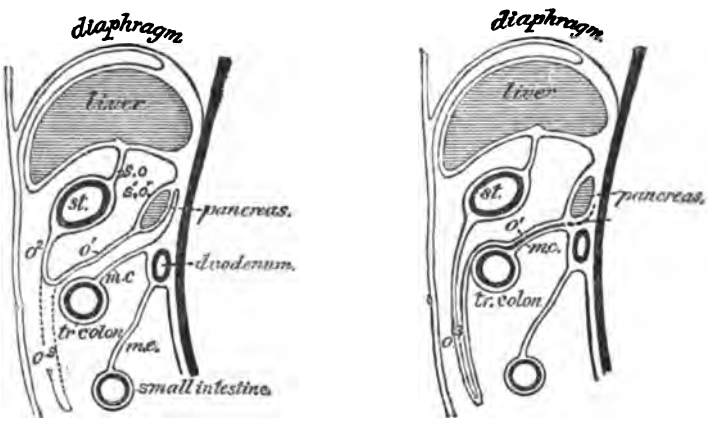
(A.) - Hertwig's and His's Statement (Adhesion Theory):—

The displaced duodenum and ascending and descending portions of the colon adhere to the peritoneum of the posterior abdominal wall, - each losing its mesentery, completely, or nearly so.

The transverse colon retains its mesentery (transverse mesocolon), at least in part, but acquires a new attachment to the posterior wall of the abdomen, along a transverse line which crosses the duodenum.

There now descends from the greater curvature of the stomach, - in front of the transverse colon, and, later on, in front of the coils of the small intestine (Figs. 322DD & EE), - an extension of the mesogastrium, which becomes the great omentum. This consists of two double folds of peritoneum. The anterior double fold, which contains the

spleen in its upper part, continues the peritoneum on the anterior and posterior surfaces of the stomach. The posterior double fold, in which the pancreas is contained superiorly,



FIGS. 322DD & EE.—DIAGRAMS ILLUSTRATING THE DEVELOPMENT OF THE GREAT OMENTUM. (Hertwig.)
A, earlier stage; B, later stage.

st., stomach; *s.o.*, small omentum; *s'.o'.*, omental sac; *o'.*, mesogastrium, springing from the posterior wall of the abdomen, near which in Fig. 322DD it encloses the pancreas; *o³*, attachment of mesogastrium to greater curvature of stomach; *o³*, fold of mesogastrium or great omentum growing over coils of small intestine; *me.*, mesentery; *m.c.*, transverse mesocolon.

is first attached to the posterior wall of the abdomen behind the stomach and a little below the diaphragm (Fig. 322DD). But adhesions becoming established (*a*) with the parietal peritoneum on the posterior abdominal wall, (*b*) with the upper layer of the transverse mesocolon, and finally (*c*) with the transverse colon itself, the arrangement is reached which is usual in the adult, by which [1] the pancreas comes to lie behind the peritoneum of the lesser sac, and [2] the posterior double fold of the great omentum appears first to embrace the transverse colon, and then to pass backwards to the spine, forming the transverse mesocolon (Fig. 322EE).

(B.) - **Counter statement by Mr. Treves** (in Morris' Anatomy), or **Displacement Theory,** agreeing with the views set forth by Mr. Bland Sutton in his classes of advanced anatomy.

The peritoneum, an extremely mobile but somewhat inextensible membrane, does not grow at the same rate as the viscera it serves to cover, and becomes less extensive, relatively to the viscera, as these increase in size. This leads to various re-adjustments, – the more rapidly growing organs robbing the less rapidly growing ones. The expanding stomach and liver, and the elongating intestine, obtain their peritoneal investment to a great extent at the expense (*a*) of the second and third portions of the duodenum, which completely lose their mesentery, and become attached directly to the posterior wall of the abdomen; (*b*) of the ascending and descending portions of the colon, whose mesentery is either narrowed or suppressed; and also somewhat (*c*) at the expense of the tranverse colon. This view seems to be supported by comparative Anatomy (*vide* below).

The liver enlarging in the superior ventral mesentery (See development of the liver, p. 132nn), the two double folds of this structure, which connect it, the one to the anterior wall of the abdomen, the other to the lesser curvature of the stomach, become, the former the suspensory falciform ligament of the liver, the other the lesser or gastro-hepatic omentum.

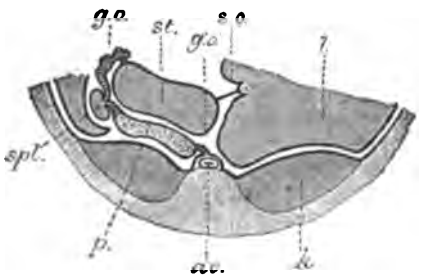


FIG. 322ff.—DIAGRAM OF A SECTION ACROSS THE ABDOMEN OF A HUMAN EMBRYO OF THE THIRD MONTH. (Toldt.)

ao., aorta; *l.* liver; *k.*, kidneys; *p.*, pancreas; *spl.*, spleen; *st.*, stomach; *g.o.*, great omentum; *g'.o'.*, omental sac; *s.o.*, small omentum. [The dotted line has not been carried quite far enough.]

The lesser sac of the peritoneum is now fully constituted: it descends from behind the stomach between the two double folds of the great omentum, – its lower portion being progressively obliterated, however, by adhesions established after birth. Its opening, bounded in front by the right or free border of the lesser or gastro-hepatic omentum, is now the foramen of Winslow.

"In the two-toed anteater the lesser sac of the peritoneum is simply a shallow

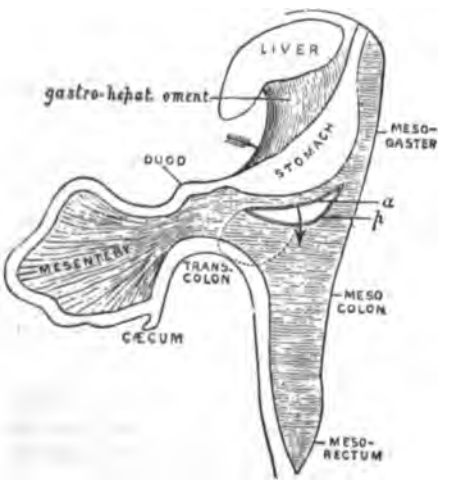


Fig. 322gg.—DIAGRAM TO SHOW THE FORMATION OF THE GREAT OMENTUM. (Treves, Morris.)

depression of the right side of the mesogastrium. In marsupials, such as the kangaroo,

it forms a loose bag with quite a wide opening. This is the condition first observable in the human fœtus. Here we have, to begin with, but a shallow and wide-mouthed bag, such as might result from the pressure of the finger on the right (afterwards posterior) aspect of the mesogastrium. By degrees the bag becomes larger and more pendulous till it hangs, like a kind of apron, in front of the colon and small intestine." (Treves in Morris' Anatomy, – somewhat condensed.)

It is patent, however, that some adhesions do take place between the layers of the great omentum. Thus it is admitted that of the lines of attachment of the peritoneum to the posterior wall of the abdomen, as shown in Prof. Cunningham's diagram, only one at all closely approaches to the original attachment of the primitive mesial mesentery; this is the line which, commencing at the falciform ligament of the liver, passes behind the liver and œsophagus, through the gastro-splenic omentum, and behind the descending colon, sigmoid flexure, and rectum. "All other lines of peritoneal reflexion must be regarded as secondary." (Treves.)

Development of the Liver.

The liver is formed in the superior ventral mesentery from two ramifying offshoots of the alimentary canal below the stomach, which embrace the left or persistent omphalo-mesenteric vein. The two lobes resulting from these ramifications are at first separated from one another, but they are subsequently joined together by the formation of a third or posterior lobe, which becomes the lobus Spigelii and lobus caudatus. The later history of the development of the liver is closely connected with that of the evolution of the portal vein (See p. 256q). The liver develops very early (2nd month) and very rapidly, and soon occupies the greater part of the abdominal cavity; it diminishes in relative size during the later part of fœtal life, and during childhood.

Development of the Pancreas.

The pancreas is developed from primary and secondary offshoots from the posterior aspect of the alimentary canal opposite the liver, – the secondary offshoot forming the small portion of the head, which has sometimes a separate duct. These offshoots ramify in the mesogastrium, where they at first form a free and movable glandular mass elongated vertically. This shares in the displacement of the stomach, and thus comes to lie transversely. Through the elongation of the mesogastrium, the pancreas comes to be embedded in the upper part of the posterior double fold of the great omentum (Fig. 322DD), and with it becomes fixed to the posterior wall of the abdomen behind the omental sac (Fig. 322EE).

Fossa Duodeno-jejunalis.

This is a pouch or pocket open above, and sometimes large enough to receive the terminal phalanx of the thumb, which Mr. Treves has found more or less marked on the left side of the fourth portion of the duodenum in nearly half the bodies examined, and which is occasionally the seat of a retro-peritoneal hernia. The pouch is bounded posteriorly by the parietal peritoneum to the left of the fourth portion of the duodenum, and anteriorly by a loose fold of the peritoneum extending from the abdominal wall in the

situation named to the anterior aspect of the intestine. It is a remnant of the early peritoneal arrangement above described, and results from the crossing of the colon in

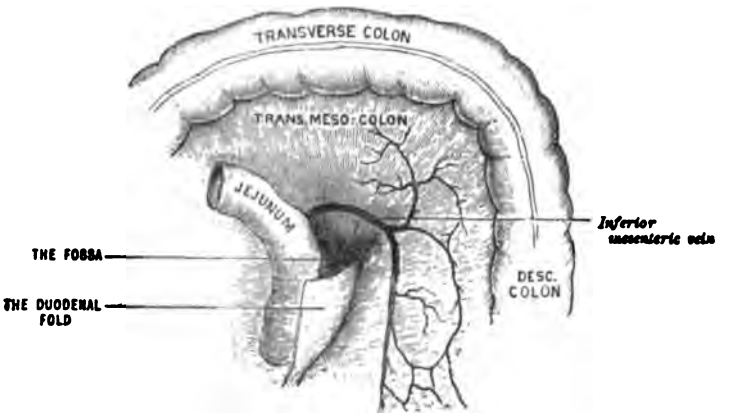


FIG. 322HH.—THE FOSSA DUODENO-JEJUNALIS. (Treves, Morris.)

front of the duodenum, - the continuous mesocolon and mesoduodenum then being folded upon each other. There is sometimes an inverted superior duodeno-jejunal fossa (Symington, Quain).

See also notes on—

The Abdominal Aponeuroses, p. 108a.

The Lumbar Fascia, p. 108c.

Relations of the Kidney, p. 152a.

NOTE TO CRITICISM AT FOOT OF PAGE 132CC.—Anyone may verify that the shape of the thigh alters visibly (1) in the standing position, (2) when sitting on a broad flat seat, and when (3) resting on a narrow ledge which just supports the ischial tuberosities. In (3) the depth of the thigh from before backwards is half as much again as in (2), while the transverse diameter of the part is proportionately reduced. Sectionally, the thigh is, in the one case, long and narrow from before backwards, in the other it is shallow and broad. There can be no doubt that the internal arrangement of the structures varies with the outward form. Every muscle, hardened in contraction, makes room for itself at the expense of muscles relaxed, and, in its turn, when relaxed, gives way to muscles contracted; a full artery (say the popliteal) furrows out the accompanying vein in proportion to the arterial tension, &c., &c. Are we to refer, under the heading of anatomy, to these shifting scenes of organic life? If not in the thigh, why in the abdomen, or elsewhere?

SUMMARY OF PRACTICAL POINTS.

(ABDOMEN.)

Linea Alba.—Is the thinnest, the least vascular, and the only non-muscular part of the abdominal wall. It is here that we make the incision for laparotomy. Behind it lie from above downwards the left lobe of the liver, the stomach, the transverse colon, the small intestine, and the bladder when distended, the anterior surface of the latter being then uncovered by peritoneum.

Lineæ Transversæ.—Generally three, the lowest being situated a little above the umbilicus; sometimes a fourth one below the umbilicus. Unimportant surgically.

Lineæ Semilunares.—Correspond to the division of the abdominal aponeuroses to form the sheaths of the recti. It is over the upper part of the left one, just below the costal cartilages, that the incision is generally made for gastrostomy.

Abdominal Aorta.—Bifurcates on the left side of the fourth lumbar vertebra, about *an inch and a half below, and a little to the left* of, the umbilicus, on a level with the highest part of the crest of the ilium.

Iliac Arteries.—Curve downwards and outwards from the above point to midway between the anterior superior spine of the ilium and the symphysis pubis, the *upper two inches* of the curve corresponding to the common iliac, and the remainder to the external. The arteries rest, though not directly, upon bone, and can be compressed through the abdominal wall. They can also be compressed on either side by Davy's rectal lever, the rectum yielding somewhat when compression is made on the artery of the right side.

Umbilicus.—Lies opposite the *third lumbar vertebra. A little below and to the left of the umbilicus*—that is just above the bifurcation of the artery—is the best place at which to compress the abdominal aorta. Here the artery has emerged from beneath the duodenum and pancreas, there is but the small intestine in front of it, and the renal vessels are well out of the way.

Spine of the Pubes.—Can easily be felt by pushing up the skin of the scrotum, or, to some extent, that of the labium, and thus getting the finger beneath the subcutaneous fat. Should there be a difficulty in finding it in the female, the tendon of the *adductor longus*, when tensed, will lead up to it. The external abdominal ring and inguinal hernia lie above and internal, and the femoral ring and hernia below and external to it.

External Abdominal Ring.—Triangular, and oblique downwards and inwards; about an inch long and half an inch wide in the male, but rather smaller in the female. Can easily be felt by invaginating the skin as above. In the normal condition it will admit the tip of the little finger. The spermatic cord can be felt emerging from it in the male.

The external abdominal ring is bounded externally by its *outer or inferior pillar*, which is attached to the *spine of the pubes;* internally by its *inner or superior pillar*, which *decussates with its fellow in front of the symphysis pubis;* below by the crest of the pubes; above by the intercolumnar fibres. From these latter there is continued downwards the *intercolumnar or external spermatic fascia*, which is closely adherent to the margins of the ring, and is prolonged inferiorly into a tubular process round the cord and testis.

Internal Abdominal Ring.—Lies about *half an inch* above Poupart's ligament, midway between the anterior superior spine of the ilium and the spine of the pubes. The deep epigastric artery runs upwards and inwards along its lower and inner boundaries.

The internal abdominal ring is a tubular opening in the fascia transversalis formed by the prolongation of that fascia round the cord and testis (infundibuliform fascia, fascia propria). It is oval, with long diameter directed downwards and outwards. It is bounded above and externally by the lower arched fibres of the internal oblique and transversalis, below and internally by the deep epigastric vessels.

Inguinal Canal.—Runs obliquely downwards and inwards above the inner half of Poupart's ligament. Is from an inch and a half to two inches long.

Its boundaries are as follows:—

In Front.—Aponeurosis of *external oblique* along its whole length; lower arched fibres of *internal oblique and transversalis* along its outer third.

Behind.—*Fascia transversalis* along its whole length; *conjoined tendon* of internal oblique and transversalis, and also the *triangular ligament*, along its inner third.

Above.—*Lower arched fibres of internal oblique and transversalis.*

Below.—*Poupart's ligament* blended posteriorly with the fascia transversalis.

Deep Epigastric Artery.—Runs from inner border of internal abdominal ring to middle of the rectus muscle. The incision for the extra peritoneal *ligature of either the common, or the upper part of the external iliac artery*, should lie entirely on its outer side. For ligature of the lower part of the external iliac artery, the incision may be made internal to the artery; but this is not, as a rule, a good operation.

Abnormal Obturator Artery.—Spine of ilium, Poupart's ligament, glands of groin.—See "Lower Limb."

(*See practical questions at end of book.*)

PELVIS & MALE GENITO-URINARY ORGANS.

PERITONEUM.

Downwards in front of spine & Aorta;
Over upper part of rectum, forming *meso-rectum*;
Forwards:
IN MALE: – To bladder, forming *posterior false ligaments of bladder* & *recto-vesical pouch*;
IN FEMALE: – To vagina & uterus, forming *posterior ligaments of uterus* & *recto-vaginal pouch*; and then over uterus & from uterus to bladder, forming *anterior ligaments of uterus* & *utero-vesical pouch*;
Over bladder and from bladder to anterior wall of abdomen;
Up to umbilicus, covering urachus & obliterated hypogastric arteries.

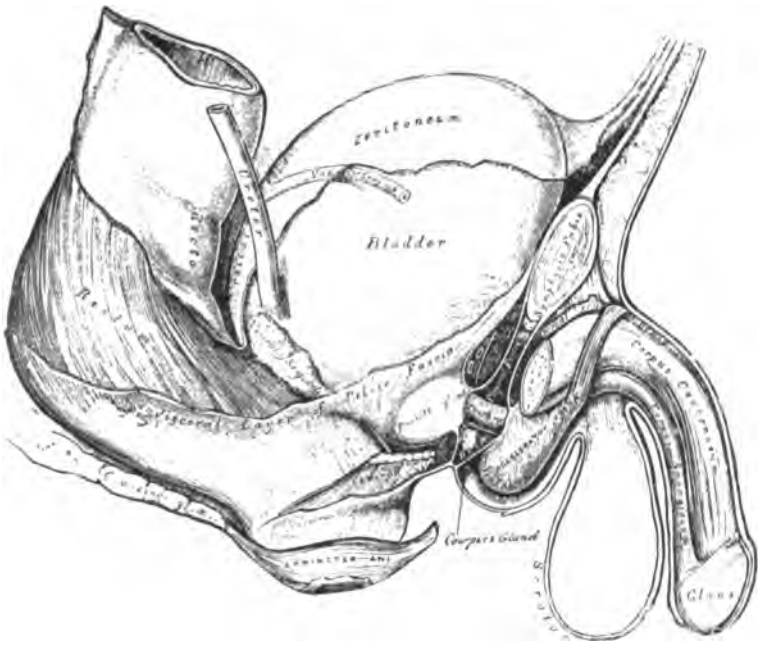


FIG. 323.—SIDE VIEW OF THE PELVIS, SHOWING THE PELVIC AND PERINEAL FASCIÆ. (Gray.)

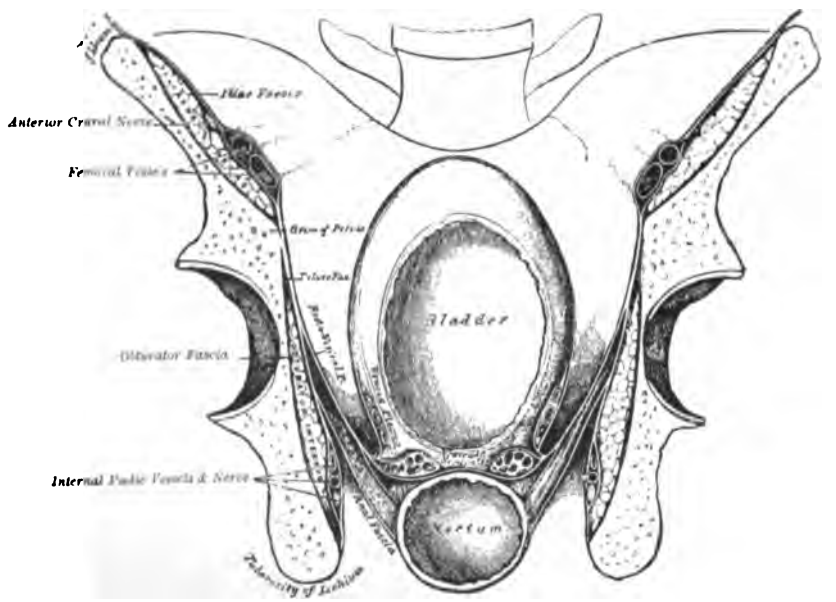
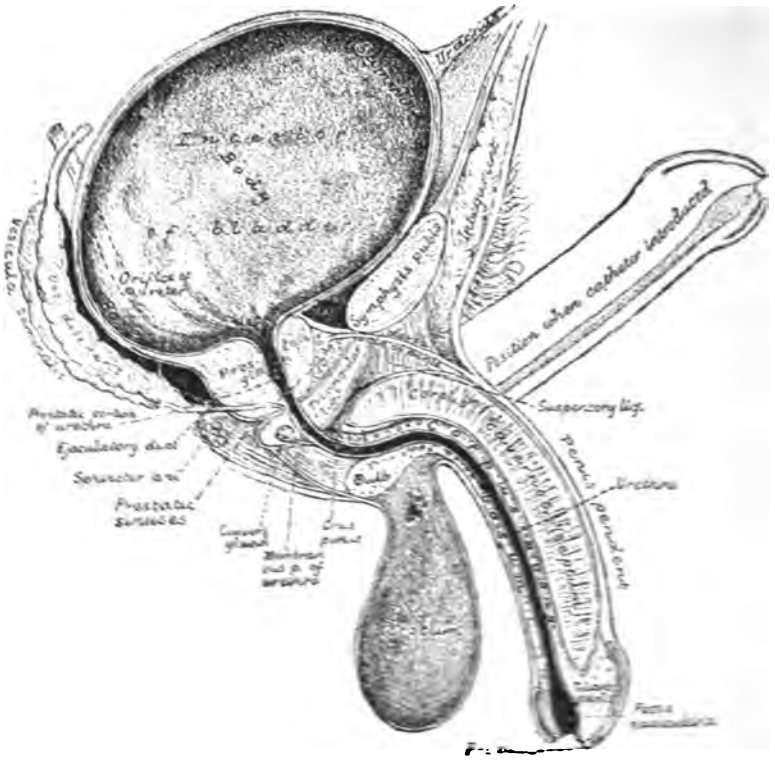


FIG. 324.—TRANSVERSE SECTION OF THE PELVIS, SHOWING THE PELVIC FASCIA. (Gray.)


Orifice of ureter
Position when catheter introduced
Suspensory lig.
Bulb
Urethra
Penis

THE PELVIC FASCIA.

Is continuous with fascia over psoas & iliacus and with fascia transversalis, and is slightly adherent to brim of pelvis, especially at sides.

It is thin posteriorly, where it covers pyriformis muscle & sacral plexus, and passes behind internal iliac vessels which perforate it.

In front it forms a single thick layer over obturator internus as low down as a white linear thickening, which linear thickening extends in a curved direction from spine of ischium to side of lower part of symphysis pubis, and both gives attachment to middle fibres of levator ani, and marks point of division of pelvic fascia into recto-vesical & obturator layers, or recto-vesical & obturator fascia.

Recto-Vesical Fascia -

Is continued over inner surface of levator ani to bladder, prostate or vagina, & rectum.

In front it forms anterior true ligaments of bladder, or pubo-prostatic ligaments.

Further back it ascends over side of prostate, inclosing this gland & the prostatic plexus of veins, and is then continued on the bladder forming its lateral true ligaments.

Posteriorly it sends a prolongation between the bladder & rectum, which prolongation invests the vesiculæ seminales.

Obturator Fascia -

Descends on portion of obturator internus muscle which lies beneath levator ani, and becomes attached to pubic arch & sacro-sciatic ligaments.

It forms a canal for pudic vessels & nerve, and gives off a thin layer, the anal or ischio-rectal fascia, to under surface of levator ani & to third part of rectum.

SIDE VIEW of the MALE PELVIS.

How to obtain it (the Perinæum having been previously dissected): –

Incline bladder & rectum to the right.
Divide on left side obliterated hypogastric, vesical & middle hæmorrhoidal arteries, (and the uterine & vaginal in female), lateral true ligament of bladder & levator ani muscle
Saw through pubes externally to left anterior true ligament of bladder.
Divide right common iliac artery & left common iliac vein, and saw through sacrum & coccyx just to the left of middle line.
Detach deep perinæal fascia & the contained compressor urethræ muscle from rami of pubes & ischium.
Introduce catheter into, and inflate, bladder; distend rectum with tow.

What it shows: –

Towards middle: –

Cut edge of the deep perinæal fascia, containing between its two layers: –
Cut edges of compressor urethræ &c deep transverse muscles;
Membranous portion of urethra;
Pudic vessels &c nerve with the vessels &c nerve of the bulb;
Cowper's glands &c their ducts.

Below and in front of the deep perinæal fascia: –

Bulb of urethra partly covered by prolongation of anterior or inferior layer of deep perinæal fascia, which latter passes down upon it and becomes lost on its surface

Above and behind the deep perinæal fascia: –

Cut edges of levator ani muscle &c of recto-vesical layer of pelvic fascia, which latter is seen further up to ascend upon bladder, prostate, &c rectum

The viscera of the pelvis and the vessels & nerves of the right side may now be examined conveniently

THE RECTUM.

Commences opposite left sacro-iliac synchondrosis.
Passes downwards & to the right to middle, or to a little to the right of middle, of third piece of sacrum.
Curves forwards upon concavity of sacrum & coccyx, regaining middle line if latter has been passed.
Inclines downwards & backwards to anus.
Is smooth & cylindrical, not sacculated; about 8 inches long. Rather narrower above than sigmoid flexure, but it increases as it descends, and is greatly dilated just above anus. – Divided into three parts:

UPPER PART — From sacro-iliac synchondrosis to middle, or to a little to the right of middle, of third piece of sacrum; about 4 inches long.
Almost completely surrounded by meso-rectum.
Separated by small intestine from bladder, in the male, & from uterus & vagina, in the female; and connected inferiorly with latter organs by the folds of peritoneum which form margins of recto-vesical & recto-vaginal pouches respectively.
Rests upon pyriformis muscle & sacral plexus of left side.
Has to its left side left ureter & branches of left internal iliac artery.

MIDDLE PART — From middle of third piece of sacrum to tip of coccyx; about 3 inches long.
Covered by peritoneum in front & at sides above, in front only towards middle, not at all below.
In relation below & in front with:
IN THE MALE – Triangular portion of base of bladder, vesiculæ seminales & vasa deferentia, and under surface of prostate.
IN THE FEMALE – Middle part of posterior wall of vagina, to which it is closely adherent.

LOWER PART — From tip of coccyx to anus; about an inch in length.
Invested by the internal & external sphincters & by the levatores ani.
Separated by a triangular space, the perinæum, from membranous portion of urethra & bulb, in the male, from vagina, in the female.

STRUCTURE — Presents:

Serous Coat – Covers upper & middle parts of rectum, the former almost completely, the latter in front & at sides above, in front only towards middle, not at all below.

Muscular Coat – Very thick; consists of fibres:
EXTERNAL LONGITUDINAL – Form a thick uniform layer all round intestine.
INTERNAL CIRCULAR – Are most numerous at lower end of rectum, where they form internal sphincter

Cellular Coat – Forms a loose connection between the muscular & mucous coats.

Mucous Membrane – Thick, very vascular, freely movable upon muscular coat. Presents:
LONGITUDINAL FOLDS – Most marked below; due to contraction of sphincter and disappear on distention.
PERMANENT TRANSVERSE FOLDS, OR FOLDS OF HOUSTON – Three principal ones, semilunar, sometimes half an inch in depth, situated at upper part on right side, near middle of rectum on left side, and at front part opposite base of bladder.

Vessels & Nerves – ARTERIES. From superior, middle & inferior hæmorrhoidal; they form a rich network beneath & within mucous membrane, the meshes of which network are mainly longitudinal in lower part of rectum, and connected opposite anus, by large transverse branches (Quain). – VEINS Also mainly longitudinal near anus; open partly into internal iliacs & partly into inferior mesenteric. – LYMPHATICS. Open into glands in hollow of sacrum, or into lumbar glands. – NERVES. From sacral plexus, 4th sacral & inferior hæmorrhoidal nerves, and from inferior mesenteric & hypogastric plexuses.

THE KIDNEY.

Is situated in lumbar region behind peritoneum, and extends from 11th rib to near crest of ilium, right kidney lying a little lower than left.

Presents:

Ant. Surface – Convex, looking slightly outwards, covered at upper & outer part by peritoneum and in relation with

On Right Side – Right lobe of liver, descending portion of duodenum, ascending colon.
On Left Side – Tail of pancreas, lower end of spleen, descending colon.

Post. Surface – Flat; rests upon 11th & 12th ribs, crus of diaphragm, psoas magnus, and anterior lamella of aponeurosis of transversalis, which latter separates it from quadratus lumborum.

Sup. Extremity – Thick, rounded, directed inwards, covered by suprarenal capsule. Corresponds on left side to upper border, on right side to lower border, of 11th rib.

Inf. Extremity – Smaller, flattened, directed outwards. Descends to near crest of ilium.

Outer Border – Convex, directed backwards & slightly upwards.

Inner Border – Concave, directed forwards & slightly downwards. Presents the *hilum*, a longitudinal fissure most marked behind, which leads into the *sinus*, and contains from before backwards renal vein, renal artery & ureter.

The kidneys are subject to frequent

VARIATIONS in:

Form & Size – One or both being longer & narrower, or shorter & more rounded; or one being more or less enlarged & the other proportionately diminished.

Situation – One or both being situated lower down than usual, occasionally in the pelvis.

Number – There being but one kidney sometimes of a horse-shoe shape & situated in front of the vertebræ, or there being a supernumerary kidney.

THE URETER.

The excretory duct of the kidney commences in the

Calices, – small tubes from 7 to 18 in number, which embrace each of them one, two or more papillæ, and join to form the

Infundibula, – larger tubes usually three in number, which join to form the

Pelvis – funnel shaped dilatation of upper part of ureter compressed from before backwards, and situated at lower & back part of hilum.

The ureter passes:

Downwards & inwards upon psoas, beneath peritoneum & spermatic vessels, and, on the right side, on right side of inferior vena cava;

Over common or external iliac artery, being covered by termination of ileum on the right side, by sigmoid flexure of colon, on the left;

Forwards & inwards, –

In the Male – In posterior false ligament of bladder, and on outer side of vas deferens & below obliterated hypogastric artery,

In the Female – In posterior ligament of uterus and over side of cervix uteri & upper part of vagina,

to posterior angle of trigonum vesicæ, passing obliquely through walls of bladder for about ½ of an inch.

It is from 16 to 18 inches long, and of about the diameter of a crow-quill.

The calices, infundibula, pelvis & ureter are formed of fibrous, muscular & mucous coats. The muscular coat consists, in the greater part of the ureter, of two longitudinal layers comprising an intermediate circular one; the epithelium of the mucous coat is spheroidal.

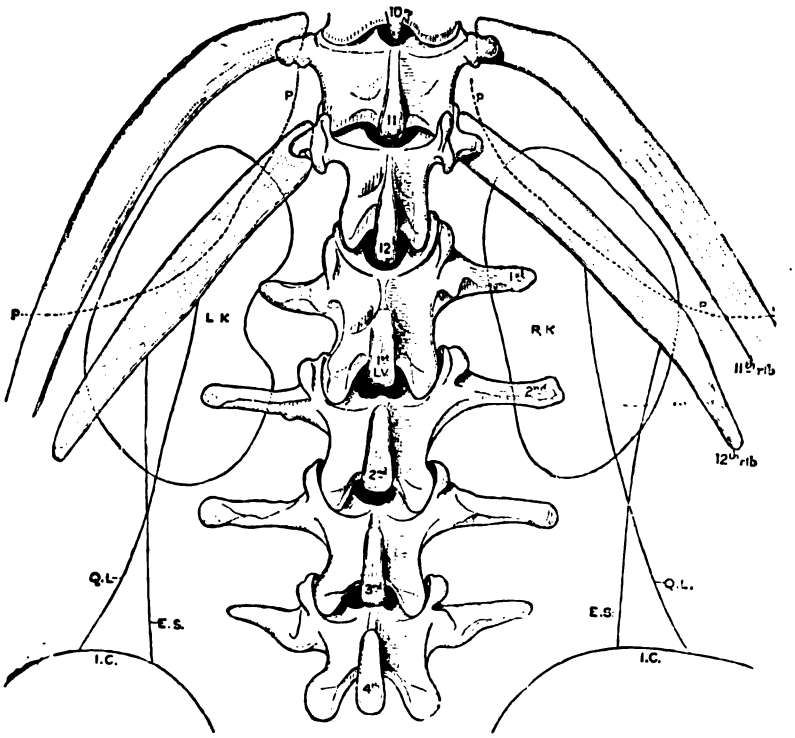


FIG. 328.—POSTERIOR SKELETAL AND OTHER RELATIONS OF THE KIDNEY. (Symington, Quain.)

ES, QL, outer border of erector spinæ & quadratus lumborum; PP, lower level of pleura; IC, iliac crest.

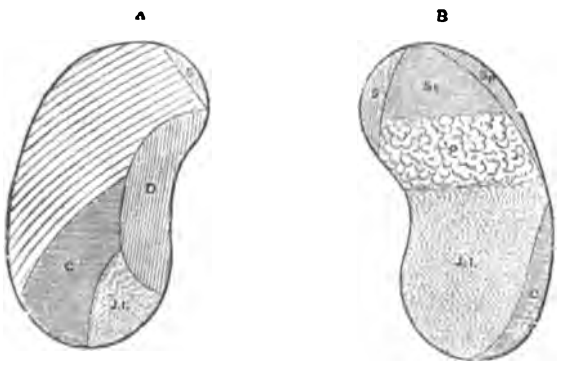


FIG. 329.—ANTERIOR RELATIONS OF THE KIDNEYS. (Symington, Quain.)

In both kidneys: S & C, areæ for suprarenal capsule & colon, non-peritoneal; and JI, jejuno-ileum, peritoneal. *In right kidney*: L, area for liver, peritoneal; D, duodenum, non-peritoneal. *In left kidney*: S & St, areæ for spleen and stomach, peritoneal; P, pancreas, non-peritoneal.

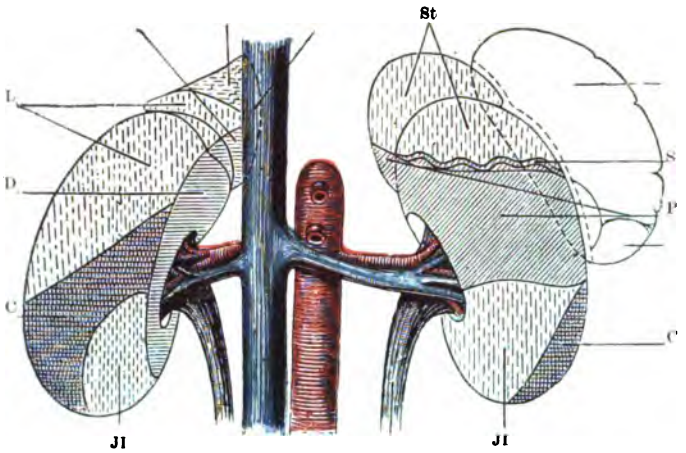


FIG. 330.—VISCERAL AREÆ OF KIDNEYS, SPLEEN, AND SUPRARENAL CAPSULES, MARKED AS IN FOREGOING FIGURE. (Anderson, Morris.)

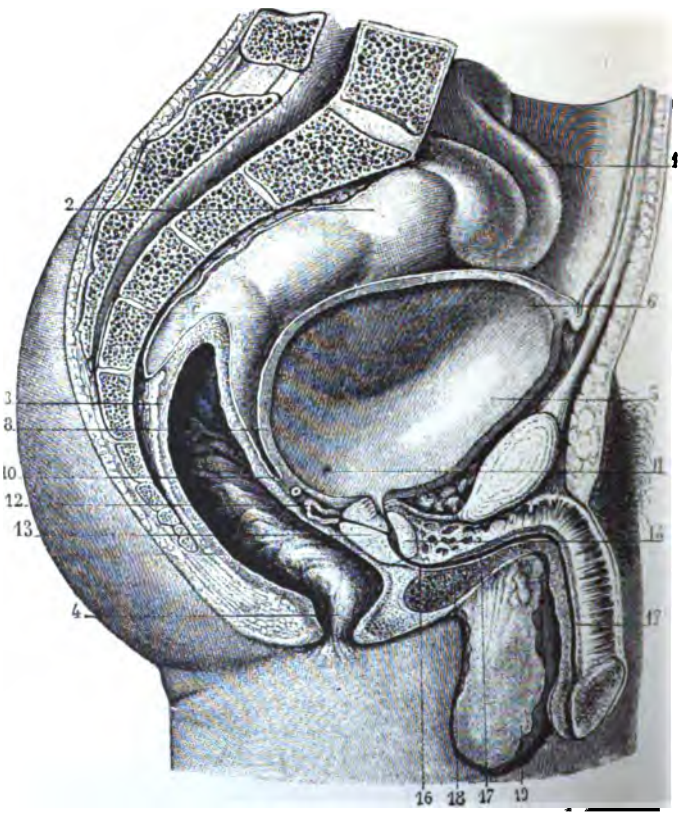


FIG. 331.—SAGITTAL SECTION THROUGH MALE PELVIS, A LITTLE TO THE RIGHT OF THE MIDDLE LINE. (Sappey.) (See expl., p. 152j.)

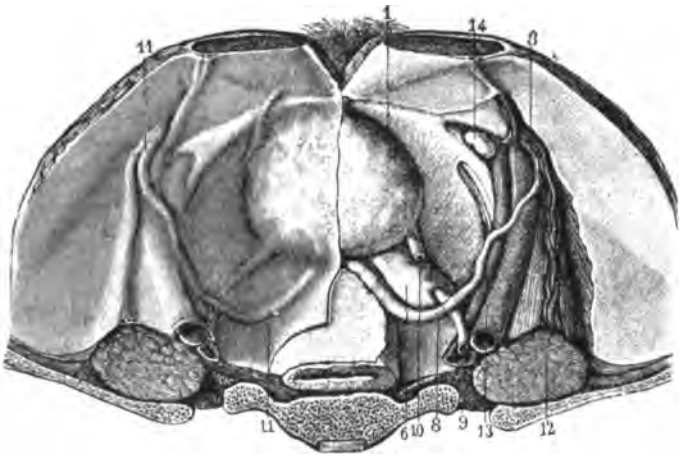


FIG. 332.—THE VISCERA OF THE MALE PELVIS SEEN FROM ABOVE, IN THEIR NATURAL CONDITION ON THE LEFT SIDE, DENUDED OF PERITONEUM ON THE RIGHT. (Sappey.)

1, bladder; 9 & 10, ureter (a portion being removed to more fully expose the vesicula seminalis, 6); (8, 8, vas deferens emerging from the internal abdominal ring on the outer side of the deep epigastric vessels, and passing between the bladder & the ureter, and then on the inner side of the vesicula seminalis. This course of the vas deferens is perhaps most clearly seen on the left side, 11, 11, where the ureter is not divided.) 12, spermatic vessels; 13, external iliac vessels: on the inner side of the vein at its termination there is seen a lymphatic gland blocking up the femoral ring; 14, deep epigastric vessels.

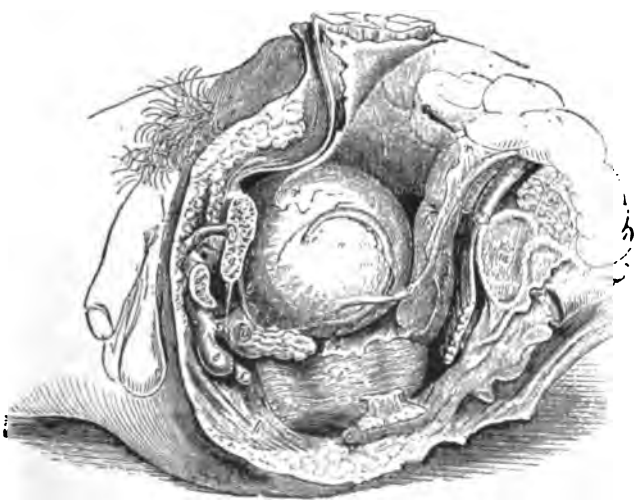


FIG. 333.—THE VISCERA OF THE MALE PELVIS SEEN FROM THE LEFT SIDE. (Quain.)

b, rectum; *a*, bladder: between this and the bladder, *a*, is the recto-vesical pouch of the peritoneum; at the lower & back part of the bladder is seen the ureter, *u*; at the upper & back part is a portion of the vas deferens, *i*, the remainder of which, similarly marked, is seen in front of the pubic symphysis; the vas deferens is seen passing between bladder & the ureter, and then getting to the inner side of the vesicula seminalis, *e*. This latter leads forwards to the prostate, *q*, and to the membranous portion of the urethra, *r*, which latter further leads to the bulb of urethra, *c*, projecting beneath it. Behind the bulb is Cowper's gland, *f*; and above its continuation, the corpus spongiosum urethræ is the section of the corpus cavernosum, *d*.

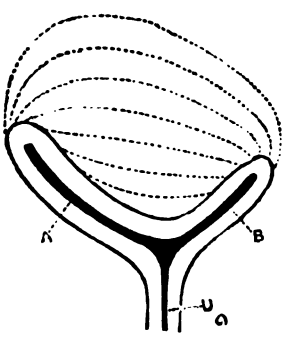
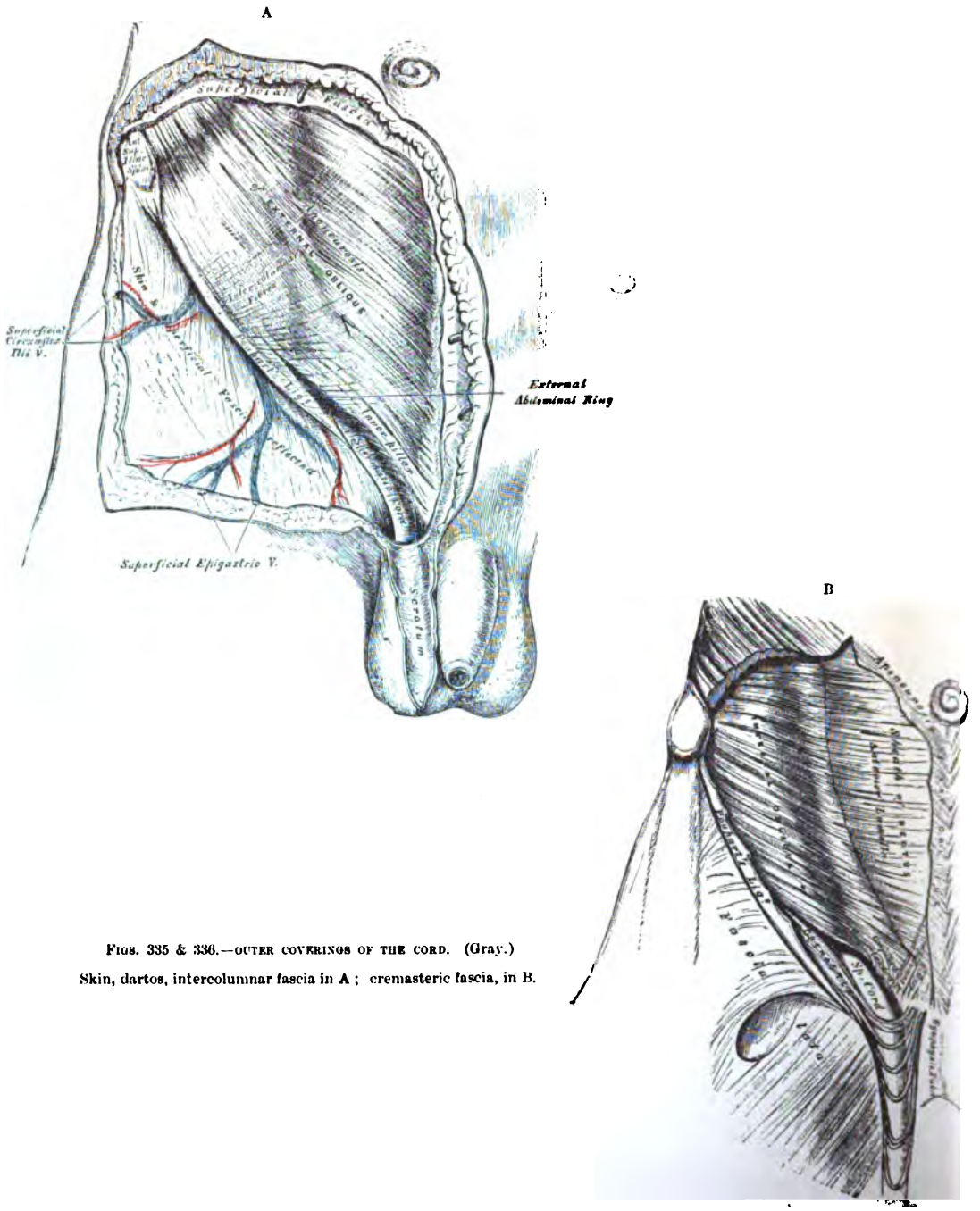


FIG. 334.—THE SHAPE OF THE EMPTY BLADDER, AS MADE OUT BY RECENT INVESTIGATION.

The heavy black line represents the cavity, and the thin black boundaries of the viscus, which is thus seen to present an upper concave surface, and two limbs, A & B. The dotted lines represent the shape of the organ in its various degrees of distention. (Symington, Quain.)



FIGS. 335 & 336.—OUTER COVERINGS OF THE CORD. (Gray.)
Skin, dartos, intercolumnar fascia in A; cremasteric fascia, in B.

THE BLADDER.

When

Empty, – Is deeply situated behind pubes, in front of rectum, in the male, of uterus & vagina, in female, and is compressed from before backwards & triangular with base downwards;
Moderately full, – Is rounded, and partly fills pelvis;
Distended, – Becomes egg-shaped, curves slightly forwards, and rises into abdominal cavity sometimes as high as umbilicus.

In Female bladder is normally smaller, though sometimes larger through distention, and is widest from side to side. In Children it is conical, and points up higher into abdomen.

Presents:

Ant. Surface – Destitute of peritoneum, and in relation with triangular ligament of urethra, pubes & pubo-prostatic ligaments, and with anterior wall of abdomen in children, and also in adults when bladder is distended.

Post. Surface – Covered by peritoneum, and separated by convolutions of small intestine from rectum in the male, and uterus in the female.

Lateral Surfaces – Crossed towards their middle by obliterated hypogastric artery, below & behind by ureter, above & behind in male by vas deferens, which latter first crosses hypogastric artery externally, and then passes between bladder & ureter. – Covered by peritoneum above & behind hypogastric artery, and rest below & in front on pelvic fascia.

Apex – Connected to umbilicus by urachus & by obliterated hypogastric arteries, behind which it is covered by peritoneum.

Base or Fundus – The enlarged part directed downwards & backwards. – In relation with

In the Male – Second portion of rectum, upon which rests the part bounded by the recto-vesical fold of the peritoneum, the vesiculæ seminales & vasa deferentia, and the prostate gland. – Is covered behind by peritoneum, the recto-vesical fold descending to about four inches from the anus when the bladder is distended, and nearly reaching the prostate when the bladder is empty.

In the Female – Anterior wall of vagina & lower part of cervix uteri.

Neck – Directed downwards & forwards, and now known to be the lowest part of the bladder both in the male & female, when in the erect posture; is surrounded in the male by the prostate gland.

LIGAMENTS of the BLADDER

Are five true ligaments, and five false ones formed by peritoneum.

TRUE LIGAMENTS — Anterior & Lateral formed by pelvic fascia & Superior or Urachus, a remnant of allantois.

ANT. OR PUBO-PROSTATIC LIGAMENTS — From back of pubes on either side of symphysis to front of neck of bladder & upper surface of prostate. Contain a few muscular fibres passing to bladder, and are separated by a narrow groove containing dorsal vein of penis.

LATERAL LIGAMENTS — Broad & thin; formed by recto-vesical layer of pelvic fascia as it passes from upper surface of levator ani to capsule of prostate & side of bladder.

URACHUS, or SUP. LIGAMENT — Fibro-muscular cord extending from apex of bladder, where it is wide & expanded, to umbilicus, where it is contracted and lost in umbilical cicatrix. Sometimes partly pervious, communicating with bladder, sometimes completely pervious forming umbilical urinary fistula.

FALSE LIGAMENTS — Posterior, Lateral & Superior.

POST. FALSE LIGAMENTS — The margins of the recto-vesical pouch of peritoneum in the male, of the utero-vesical pouch in the female, where they are much smaller. Contain the obliterated hypogastric arteries & ureters.

LATERAL FALSE LIGAMENTS — From sides of pelvis to sides of bladder.

SUP. FALSE LIGAMENT — Over urachus & obliterated hypogastric arteries to umbilicus.

COVERINGS of the TESTICLE.

Are the: -

Scrotum - Consists of two layers:

INTEGUMENT - Thin & brownish; presents a few sebaceous follicles & thinly scattered crisp hairs, and is divided into two lateral halves by a median raphé, which raphé is continued forwards on under surface of penis and backwards along middle line of perinæum to anus. Is closely applied to the testes and is corrugated transversely when the dartos is contracted, that is to say, usually in the young & robust, and in all under the influence of cold, and is elongated & flaccid when the dartos is relaxed, that is to say, usually in the debilitated & aged, and in all under the influence of warmth.

DARTOS - Is a thick stratum of loose reddish tissue, a modification of the superficial fascia of the surrounding regions, consisting of areolar tissue with numerous superadded muscular fibres and without any fat; it sends inwards between the two testicles a septum, the *septum scroti*, which divides its cavity into two. - It is contractile, but its contractility is slow in its action, and especially excited by cold, not by electricity.

Intercolumnar or External Spermatic Fascia - Thin cellular layer derived from the margins of the external abdominal ring during the descent of the testis, and continuous above with the intercolumnar fibres, which bound that ring superiorly.

Cremasteric Fascia - Consists of the scattered bundles of fibres of the cremaster & internal oblique muscles united by a little areolar tissue.

Fascia Propria - Relatively thick layer, the continuation of the infundibuliform process of the fascia transversalis, which layer supports both the cremasteric fascia & the tunica vaginalis reflexa.

Tunica Vaginalis - Is derived from the peritoneum, of which it is at first a continuation, but from which it is subsequently cut off by the closure of that part of the peritoneal pouch, which extends from the internal abdominal ring to a short distance from the testicle. - Is divided into:

VISCERAL PORTION OR TUNICA VAGINALIS PROPRIA - Surrounds the testicle, and covers both the upper or outer surface of the epididymis and also the under surface of its central part or body, penetrating, along its outer border, between it & the testicle, and thus forming the *digital fossa*.

PARIETAL PORTION, OR TUNICA VAGINALIS REFLEXA - Is reflected from the posterior border of the testicle upon the inner surface of the fascia propria, extending, however, a short distance up the cord upon its anterior & inner aspect.

Tunica Vaginalis
" Reflexa

THE TESTICLE & EPIDIDYMIS.

THE TESTICLE

Is oval & compressed laterally, and so suspended by the spermatic cord as to present:

Upper Extremity – The largest, directed forwards & outwards. Presents a small pedunculated body, the hydatid of Morgagni, probably a remnant of Muller's duct.

Lower Extremity – The smaller, directed backwards & inwards.

Lateral Surfaces – Looking respectively forwards & inwards, and backwards & outwards.

Anterior Border – Convex, directed forwards, downwards & outwards. – All these parts are free, smooth, and entirely invested by the tunica vaginalis propria.

Posterior Border – Straight & flattened, directed backwards, upwards & inwards, covered by the epididymis & vas deferens, and only partly invested by the tunica vaginalis.

The left testicle lies a little lower than the right one, and is frequently a little larger.

THE EPIDIDYMIS

Lies on the posterior border and back part of the outer surface of the testicle, and has the vas deferens on its inner side. It presents:

Globus Major or Head – Its upper enlarged extremity, connected to the testicle by the efferent ducts of the latter.

Body – Free, surrounded by the tunica vaginalis, which dips in between it & the testicle along its outer border, and connects its inner or posterior border to the posterior border of the testicle.

Globus Minor or Tail – Its lower pointed extremity, attached to the testicle by dense fibrous tissue.

The tunica vaginalis covers the whole of the upper or outer surface of the epididymis, as well as the under surface of its body. – The vas aberrans of Haller communicates with the canal of the epididymis or with the commencement of the vas deferens

STRUCTURE of the TESTICLE & EPIDIDYMIS.

STRUCTURE of the TESTICLE — Presents for examination: -

THREE IMMEDIATE COVERINGS: —

Tunica Vaginalis - Vide Coverings of the testicle.

Tunica Albuginea - Thick, dense, bluish-white, fibrous membrane, covered ex-
nally by the tunica vaginalis propria except along the points of at-
ment of the epididymis & vas deferens, and reflected into the inter-
the testicle along its posterior or upper border in the shape of an im-
plete vertical septum, the mediastinum testis or Corpus Highmori -
This latter body supports the vessels & nerves and the excretory ducts
the testicle in their passage to or from the gland, and gives off numer-
trabeculæ, which radiate towards the whole extent of the inner surface
the tunica albuginea, and inclose the numerous pyramidal spaces con-
taining the lobules of the gland substance.

Tunica Vasculosa or Pia Mater Testis - Consists of a plexus of blood-ves-
held together by delicate areolar tissue, and formed by the subdivision
the superficial set of brs. of the spermatic artery. Branches given off by the
plexus, penetrate into the substance of the gland, supported by the trabeculæ

PROPER SUBSTANCE or PARENCHYMA — Consists of numerous pyramidal

lobules contained in the pyramidal spaces bounded by the trabeculæ, and pre-
senting a base directed towards the surface of the testicle and an apex direc-
towards the mediastinum. Of these lobules the central ones are the lar-
The degree to which the lobules are isolated by the trabeculæ is somewhat vari-
able, hence the different estimates of their number, 250 (Berres), 400 (Kra-

Each lobule consists of from *one to three or more tubuli seminiferi*, the num-
& the length of which tubuli has also been variously estimated,- 300, sixteen fe-
in length (Monro), 840, two feet & a quarter in length (Lauth). - The diameter o
the tubuli is from $\frac{1}{100}$ to $\frac{1}{150}$ of an inch. They consist from without inwards of a
delicate fibro-areolar coat, a basement membrane, and sometimes a layer of
granular nucleated epithelium. The epithelium is absent, however, when the
gland is particularly active; the tubuli are then filled with cells of different sizes
without any regular arrangement.

The *tubuli seminiferi* commence towards the surface of the testicle, sometimes
by free cæcal or blind extremities, but more commonly by anastomatic loops. They
are exceedingly convoluted in the peripheral part of the gland; their convolutions
are of two orders, viz., a fine & regular undulation giving a granular appear-
ance to the whole of their mass, and a more complicated folding of the undulating
tube. Towards the apices of the lobules they become straighter, and they coalesce
into from twenty to thirty straight tubes the *vasa recta*, which are from $\frac{1}{100}$ to $\frac{1}{60}$
of an inch in diameter.

The *vasa recta* enter the mediastinum, and passing upwards & backwards,
they form within that body a network of anastomosing tubules, the *rete testis*
or *rete vasculosum testis*.

The rete testis is continued superiorly into from twelve to fifteen or twenty
vasa efferentia

The *vasa efferentia* perforate the tunica albuginea at the upper & back part
of the testicle. In their extra-testicular course, which is about 6 or 8 inches
long, they are at first straight & relatively wide, but they soon become convoluted
& slightly narrowed, and form a series of conical masses, the *coni vasculosi*, which
latter constitute together the globus major of the epididymis. They are lined
with ciliated epithelium.

The excretory ducts of the testicle open finally into the commencement of
the canal of the epididymis at apparently narrow intervals, which intervals
however, are seen, when the canal of the epididymis is unravelled, to measure from
two to three inches in length

STRUCTURE of the EPIDIDYMIS — The epididymis consists of a single tube about

twenty feet long, by which the tubuli seminiferi open into the vas deferens. It
is at first very thin & exceedingly convoluted, and of a diameter of about $\frac{1}{50}$ of an
inch. It diminishes a little in size for a short distance, but it soon increases con-
siderably, the thickness of its walls increasing also, and its course becoming less
tortuous. A little fine areolar tissue binds its convolutions together, thicker septa
being interposed between the larger masses of coils termed *lobes*, which latter are
mostly transverse in direction. The epithelium of the canal of the epididymis is
ciliated (Becker, Kölliker). - The Vas aberrans of Haller (Vide spermatic cord) is
usually connected either with the canal of the epididymis or with the commence-
ment of the vas deferens

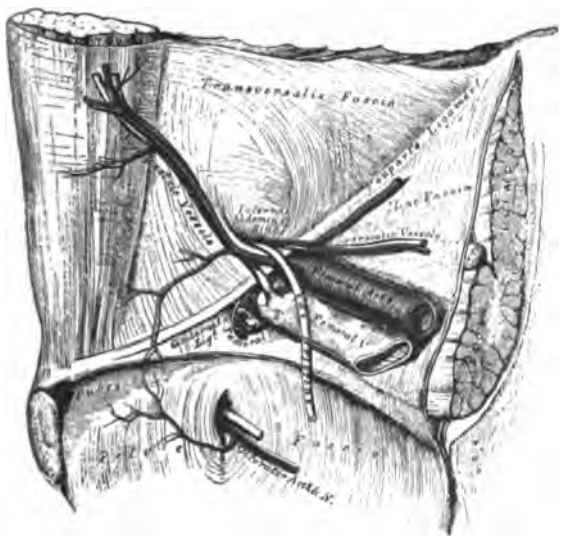


FIG. 337.—Posterior aspect of right half of anterior wall of abdomen, showing origin of fascia propria from the fascia transversalis at the internal abdominal ring, and the diverging elements of the spermatic cord. (Gray.)

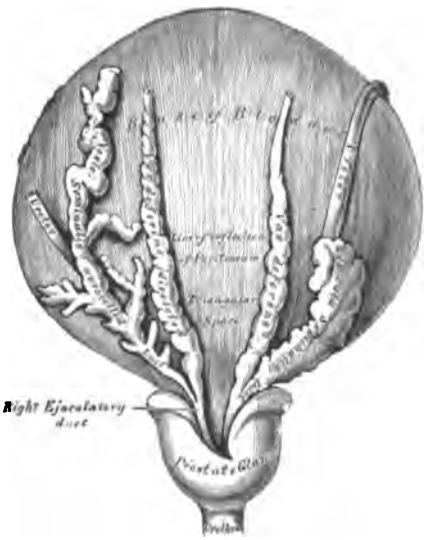


FIG. 338. The bladder and prostate seen from behind, showing the ureters, vasa deferentia, and vesiculæ seminales; the left vesicula seminalis being dissected. (Gray.)

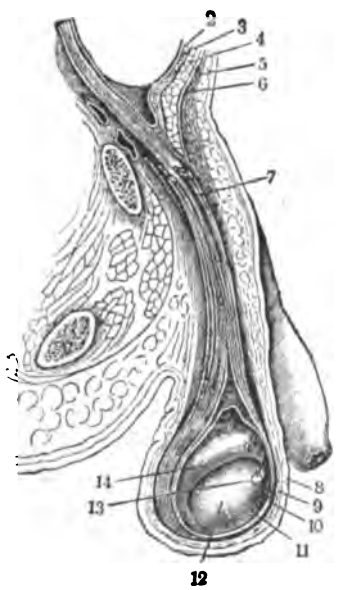


FIG. 339.—SAGITTAL SECTION, SHOWING THE COVERINGS OF THE CORD AND TESTICLE. (Henle.)

2, peritoneum and sub-serous areolar tissue, showing a depression at the internal abdominal ring (external inguinal fossa); 3, fascia transversalis, seen continued into the fascia propria; 4, internal oblique muscle; 5, aponeurosis of the external oblique continued into the intercolumnar fascia, 10; 8, skin of scrotum; 9, dartos; 10, tunica vaginalis; 11, tunica vaginalis reflexa; 12, testicle; 13, hydatid of Morgagni; 14, epididymis.

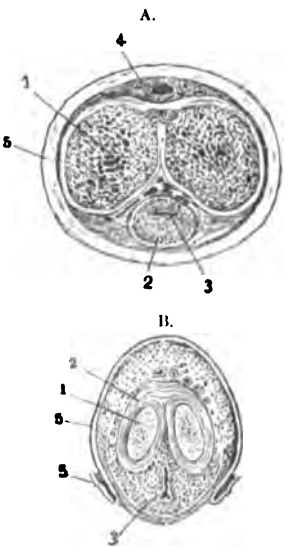


FIG. 340.- TRANSVERSE SECTION OF PENIS: A, NEAR ROOT; B, THROUGH GLANS. (Henle.)

1, corpus cavernosum; 2, corpus spongiosum; 3, urethra; 4, dorsal vessels and nerves; 5, skin and prepuce.

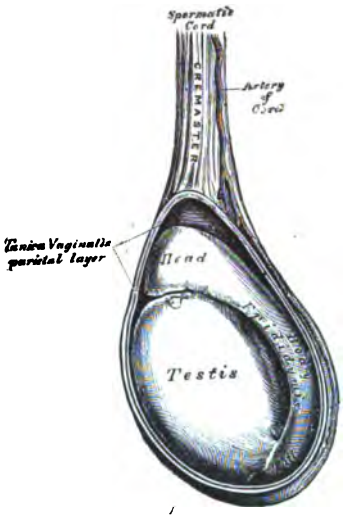


FIG. 341.—The testicle and epididymis *in situ*, the tunica vaginalis having been opened. (Gray.)

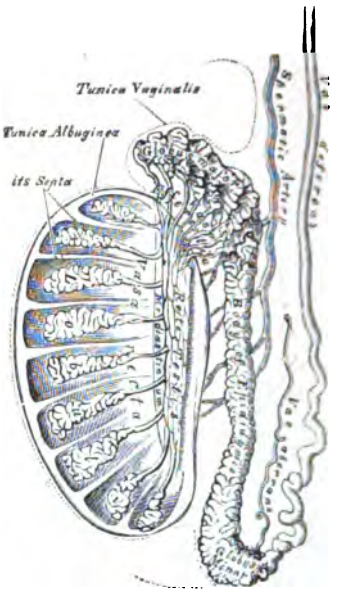


FIG. 342.—Sagittal section of testicle, showing corpus Highmorianum and arrangement of ducts. (Gray.)

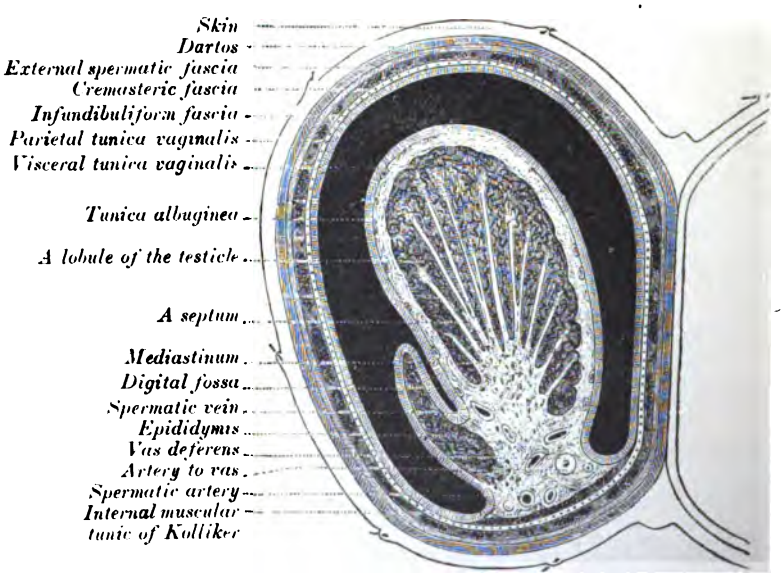


FIG. 343.—TRANSVERSE SECTION THROUGH TESTICLE AND ITS COVERINGS. (Gray.)

THE VAS DEFERENS, VESICULÆ SEMINALES, & EJACULATORY DUCTS.

VAS DEFERENS

Ascends on inner side of epididymis along lower three-fourths of posterior border of testicle, to which it is attached by firm areolar tissue.

Along back of spermatic cord to external abdominal ring;

Through external abdominal ring, inguinal canal & internal abdominal ring;

Downwards, backwards, inwards to base of bladder, passing on outer side of epigastric & obliterated hypogastric arteries and then on inner side of ureter;

Forwards & inwards between bladder & rectum, along inner side of vesicula seminalis becoming enlarged & sacculated;

Narrows to a point, and joins opposite base of prostate with duct of corresponding vesicula seminalis, to form the common seminal or ejaculatory duct.

Its canal is very small. Its walls are very thick & dense, and consist from without inwards of a cellular coat, of a muscular coat presenting two longitudinal layers & an intermediate circular layer of fibres, and of a mucous coat covered with columnar non-ciliated epithelium.

The vas aberrans of Haller communicates with the canal of the epididymis or with the commencement of the vas deferens.

VESICULÆ SEMINALES

Two lobulated membranous pouches about 2½ inches long obliquely disposed between base of bladder & second part of rectum, and presenting:

Post. Diverging Extremities – Enlarged, and reach as far back as termination of ureters.

Ant. Converging Extremities – Pointed; join at base of prostate with termination of the corresponding vas deferens to form the common seminal or ejaculatory duct.

Upper Surface – In contact with base of bladder.

Under Surface – Rests upon second part of rectum, from which it is separated by a process of the recto-vesical layer of the pelvic fascia.

They have the enlarged & sacculated vasa deferentia to their inner side, and bound laterally a triangular portion of the base of the bladder which corresponds to trigonum vesicæ.

Each vesicula seminalis consists of a tube from four to six inches long, and of about the diameter of a crow quill. This tube is irregularly coiled upon itself, and gives off numerous cœcal diverticula, which, as well as the coils of the tube, are bound together by firm areolar tissue. Its walls are thin, and consist of fibrous, muscular & mucous coats, the epithelium of the latter being squamous.

EJACULATORY DUCTS

Two small canals about ¾ of an inch in length formed by the junction opposite the base of the prostate of the vas deferens with the duct of the vesicula seminalis.

They pass forwards & inwards through the substance of the prostate along the side of the verumontanum, and terminate by a slit-like opening upon or within the margins of the vesicula prostatica or sinus pocularis.

Their walls are thin, and consist of a delicate fibrous coat & of muscular & mucous coats.

THE SPERMATIC CORD.

Consists of the portion of the vas deferens which extends from the testicle to the internal abdominal ring, and of the accompanying arteries, veins, lymphatics, & nerves and contains the vas aberrans & the organ of Giraldes. These structures are bound together by delicate areolar tissue, and are invested from within outwards by:

- *Tunica vaginalis*, below;
- *Fascia propria*, along the whole
- *Cramasteric fascia*, along nearly the whole of the course of the cord;
- *Intercolumnar fascia, dartos & skin of the scrotum*, below the external abdominal ring

Vas deferens – Lies at the back.

Arteries – Are the *spermatic*, the *artery of the vas deferens* from the superior vesical, and the *cremasteric* branch of the epigastric.

Veins – Are the spermatic veins, which pass up in front of the vas deferens, forming the *pampiniform plexus*, and then unite in a single trunk, which accompanies the abdominal portion of the spermatic artery and terminates in the left renal vein, on the left side, in the inferior vena cava, on the right.

Lymphatics – Terminate in the lumbar glands.

Nerves – Are the *ilio-inguinal*, the *genital branch of the genito-crural*, frequently a branch of the ilio-hypogastric, and the *spermatic plexus of the sympathetic*, which latter is derived from the renal, aortic & hypogastric plexuses.

Vas Aberrans (HALLER) – A narrow tortuous tube from 1½ to 1¼ inches long, connected with the commencement of the vas deferens or with the lower part of the canal of the epididymis, and passing upwards for 1 or 2 inches among the other vessels of the spermatic cord. It ends in a blind extremity, and is sometimes unconnected with the seminal ducts. It was probably connected in the fœtus with the Wolffian body.

Organ of Giraldes – A collection of minute convoluted tubules, probably a remnant of the Wolffian body, found in the lower & front part of the cord close to the head of the epididymis

THE PROSTATE GLAND.

Is a pale firm glandular structure of about the size & shape of a horse-chesnut, situated beneath the trigonum vesicæ and around the neck of the bladder & commencement of the urethra; below and behind the symphysis pubis & the pubo-prostatic ligaments or anterior true ligaments of the bladder; above & in front of the second part of the rectum and the point of decussation of those anterior or inner fibres of the levator ani which form the levator prostatæ; between the two lateral halves of the posterior or ascending layer of the deep perinæal fascia or triangular ligament, and between the two lateral halves of the ascending portion of the recto-vesical layer of the pelvic fascia.

It measures normally from 1¼ to 1½ inches in its antero-posterior diameter, 1⅞ inches in its greatest transverse diameter (Sir H. Thompson), and about ⅝ of an inch in depth; these measurements undergo, however, great variations in old persons, who are frequently the subjects of enlarged prostate.

It consists of two lateral lobes separated behind by a deep notch, and of a third or middle lobe which is normally but a small rounded or triangular mass fitted in between the two lateral lobes in the under part of the organ, and lying between the ejaculatory ducts immediately beneath the neck of the bladder. The degree of development of this middle lobe, is however, very variable, it being often much enlarged in advanced life, and then projecting into the neck of the bladder so as to impede the passage of urine.

It presents for examination:

BASE — Directed backwards & upwards towards the trigonum vesicæ & the neck of the bladder, and notched posteriorly.

APEX — Passes downwards & forwards between the posterior or ascending layers of the deep perinæal fascia or triangular ligament.

UPPER SURFACE — Covered by and connected to the pubo-prostatic ligaments or ant. true ligaments of the bladder and the front part of the recto-vesical layer of the pelvic fascia. Is situated about ⅝ of an inch below & behind the symphysis pubis, and presents a slight longitudinal furrow.

UNDER SURFACE — Rests upon the lower part of the second portion of the rectum (just opposite the bend between the second & third portions), a process of the recto-vesical layer of the pelvic fascia being interposed between the two organs. Presents a slight depression, or sometimes two converging grooves which correspond to the ejaculatory ducts and which demarcate the central lobe.

LATERAL SURFACES — Covered by the layers of fascia above mentioned, by those anterior or inner fibres of the levatores ani which go to form the levator prostatæ, and by the reflections of the peritoneum from the bladder to the sides of the pelvis which reflections form the lateral false ligaments of the bladder.

It is perforated by the urethra, which usually lies nearer its upper than its lower surface, and also by the ejaculatory ducts which pass forwards & inwards through the lower part of the gland along the side of the verumontanum, and terminate by a slit-like opening upon or within the margins of the vesicula prostatica or sinus pocularis.

STRUCTURE — Structurally the prostate presents:

Fibrous Capsule — Distinct from the fibrous investment derived from the two halves of the posterior or ascending layer of the deep perinæal fascia & from the recto-vesical layer of the pelvic fascia, and separated from these by prostatic plexus of veins. It sends off fibrous prolongations into the interior of the gland.

Glandular Substance — Consists of follicular pouches which are grouped around, and open into, numerous elongated canals, by the junction of which from twelve to twenty excretory ducts are formed; these open into the prostatic sinus on the floor of the prostatic portion of the urethra.

Muscular Fibres — Are abundant in the fibrous capsule. The urethra is surrounded, as it passes through the prostate, by a thick layer of circular fibres continuous behind with the fibres of the sphincter vesicæ, and in front with those of the membranous portion of the urethra.

Vessels & Nerves — Arteries are derived from the internal pudic, vesical & middle hæmorrhoidal. Veins form an important plexus around sides & base of prostate; they receive in front the dorsal vein of the penis, and open behind into internal iliac vein. Lymphatics ramify on the outer surface of the capsule. Nerves are derived from hypogastric plexus.

THE MALE URETHRA.

Is about 8½ inches long, and extends from neck of bladder to end of penis.
It presents beneath the pubes a fixed curve concave superiorly, and in front of the pubes in the flaccid state of the penis, a second flexible curve concave inferiorly
It is divided into: –

PROSTATIC PORTION — The widest & most dilatable part, spindle-shaped, 1¼ inches long; passes through the prostate from base to apex, lying nearer its upper than its lower surface. Its transverse section is of a horse-shoe shape concave inferiorly. On its floor are the following parts: –

URETHRAL CREST, VERUMONTANUM OR CAPUT GALLINAGINIS – Longitudinal elevation 8 or 9 lines in length and 1½ lines high at its central & highest part, consisting, according to Kobelt, of muscular fibres & erectile tissue. On either side of the crest is a

PROSTATIC SINUS – A longitudinal groove into which open the ducts of the lateral lobes of the prostate. On the front part of the crest is the

UTRICLE, SINUS POCULARIS OR VESICULA PROSTATICA – An expanding cul-de-sac, which passes backwards into the substance of the middle lobe of the prostate for about a quarter of an inch, and upon or within the margins of which are the slit-like openings of the ejaculatory ducts

MEMBRANOUS PORTION —The shortest, and, excepting the meatus, the narrowest part of the canal. It extends from apex of prostate to bulb of corpus spongiosum, and is situated between the two layers of the deep perineal fascia, which layers are prolonged around it, the one downwards & forwards, the other upwards & backwards. Its upper surface is concave superiorly, ¾ of an inch long, and situated about an inch below & behind the pubic arch, from which arch it is separated by the anterior fibres of the compressor urethræ muscle & by the dorsal vessels & nerves of the penis. Its under surface is convex inferiorly, only ½ inch long (in consequence of the bulb projecting backwards beneath the urethra), and separated from the rectum by a triangular space, broad below, narrow above, the perinæum.

SPONGY PORTION — Commences within the bulb below & behind the symphysis pubis, ascends a short distance in front of the symphysis within the corpus spongiosum, curves downwards with the latter in the flaccid state of the penis, and ends at the meatus urinarius. It is about six inches long. In the greatest part of its course it is uniform in size, and intermediate between the prostatic & membranous portions; it is dilated however, within the bulb & within the glans penis (in which latter situation the dilatation forms the fossa navicularis), and is greatly constricted at the meatus. Its transverse section is elongated from side to side except within the glans penis, where it is elongated vertically. On its walls, and more particularly on its floor, are the openings of numerous mucous glands, the glands of Littre, which openings are directed forwards, and are sometimes large enough to intercept the passage of small catheters; this is especially the case with one of them, which is situated on the upper wall of the fossa navicularis, and which constitutes the lacuna magna. On the floor of its posterior dilated portion comprised within the bulb, and sometimes termed the bulbous portion, are the openings of the ducts of Cowper's glands.

STRUCTURE — Three coats: –

Mucous Coat – Thin, pale in the prostatic portion, rosy in the membranous & spongy portions, in which it is thrown into longitudinal folds (except when the canal is distended with urine). Covered with columnar epithelium except in the fossa navicularis, where the epithelium is squamous. Presents the glands of Littre above described, which glands are most abundant in the spongy portion, and presents also, near the meatus, a few pap

Muscular Coat – Consists of external longitudinal & internal circular unstriped muscular fibres, both most abundant in the prostatic portion

Erectile Coat – Thick in the spongy portion, where it forms the corpus spongiosum (Vide Structure of the Penis). From this a thin layer of erectile tissue is prolonged upwards round the membranous & prostatic portions as far as the neck of the bladder, forming in the prostatic portion, according to Kobelt, the verumontanum or caput gallinagi

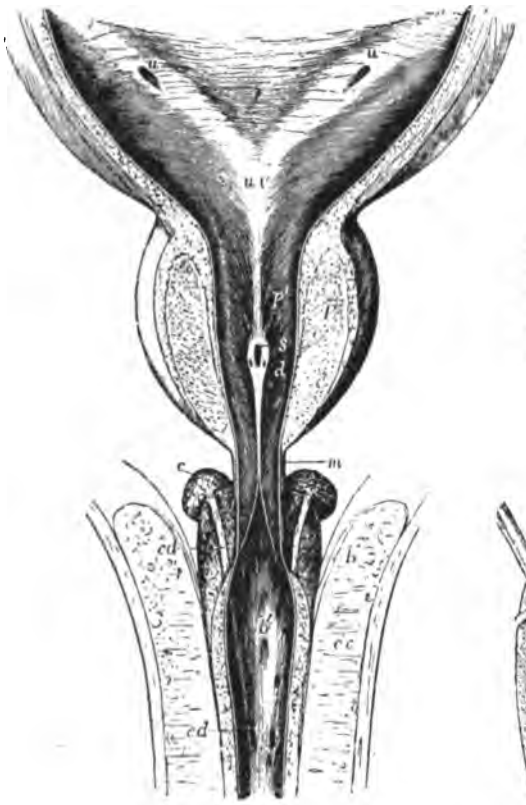


FIG. 344.—TRIGONUM VESICÆ AND THE PROSTATIC, MEMBRANOUS, AND BULBOUS PORTIONS OF THE URETHRA OPENED FROM ABOVE. (Quain.)

t, trigonum; *u*, oblique openings of ureters; *p*, prostate; *p'*, prostatic portion of urethra, with verumontanum in the middle line extending up to the uvula vesicæ, *ue*; *s* & *d*, openings of utricle and of common seminal or ejaculatory ducts; *m* & *b'*, membranous & bulbous portions of the urethra; *b*, bulb; *c* & *cd*, Cowper's glands and their ducts; *cc*, corpora cavernosa.

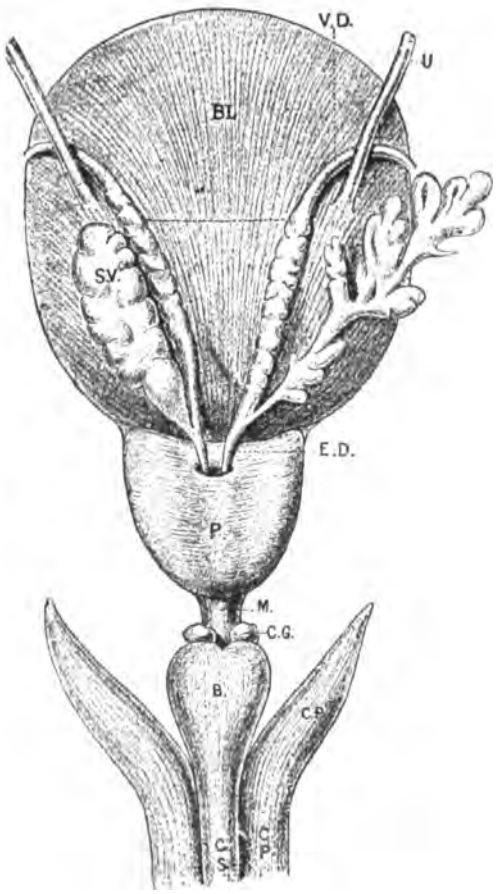


FIG. 345.—STRUCTURES AT BASE OF THE MALE BLADDER, PROSTATE, ETC. (Symington, Quain.)

BL, part of the distended bladder covered by peritoneum, separated by a dotted line from the triangular space left uncovered; U, ureter; SV, vesicula seminalis, with the vas deferens, VD, on its inner side: the right one is dissected; ED, common seminal or ejaculatory duct; P, prostate; M, membranous portion of the urethra; B, bulb; CS, corpus spongiosum; CG, Cowper's glands; CP, corpora cavernosa.

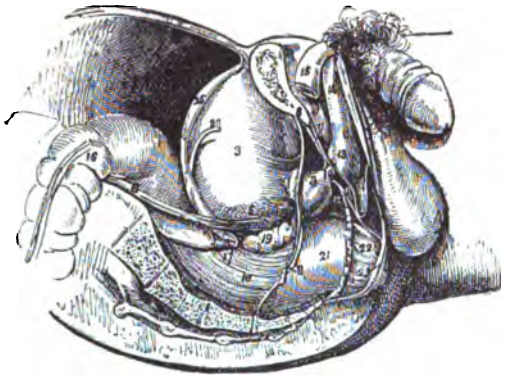
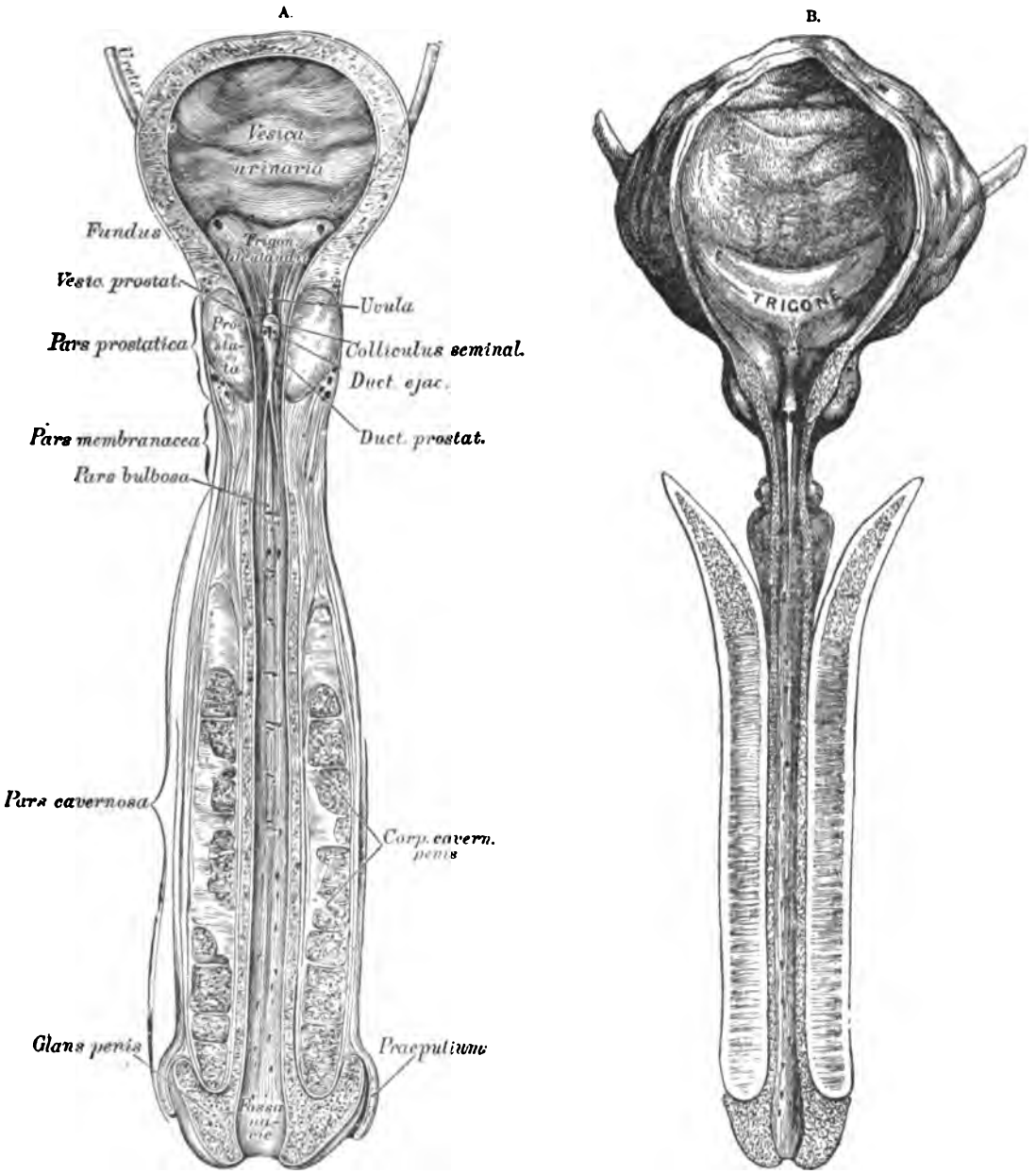


FIG. 346.—THE VISCERA OF THE MALE PELVIS, SEEN FROM THE RIGHT SIDE. (Wilson.) (See expl., p. 152j.)

FIG. 347.—SAGITTAL SECTION THROUGH PELVIS OF MALE ADULT. (Braune, Quain.)

1st S, body of 1st sacral vertebra; PS, symphysis pubis; Bl, bladder; R, R, R, rectum prostate; P', middle lobe; F, retro-pubic pad of fat; Bu, bulb; JI, jejuno-ileum.



FIGS. 348 & 349.- THE BLADDER AND URETHRA LAID OPEN. (A. Heitzmann ; B. Holden.)

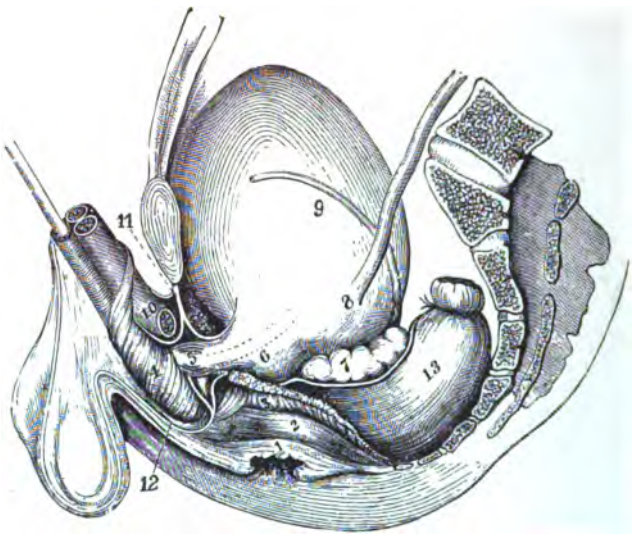


FIG. 350.—SIDE VIEW OF VISCERA OF MALE PELVIS. (Holden.)

1, 2, external and internal sphincters; 3, levator ani, divided; 4, bulb covered by accelerator urinæ; 5, membranous portion of the urethra between the two layers of the triangular ligament; 6, prostate; 7, vesicula seminalis; 8, ureter; 9, vas deferens; 10, crus penis, divided; 11, triangular ligament; 12, deep layer of superficial fascia of perinæum.

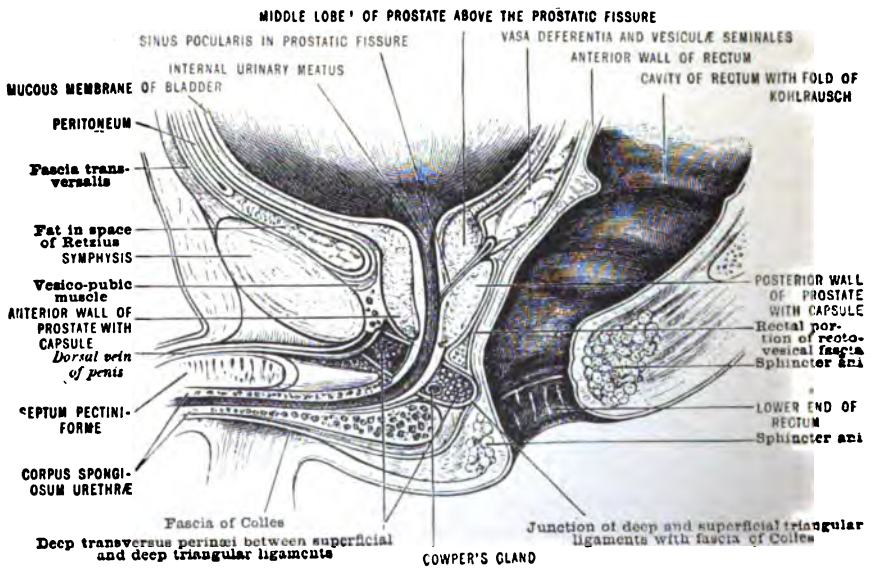

MIDDLE LOBE OF PROSTATE ABOVE THE PROSTATIC FISSURE
SINUS POCULARIS IN PROSTATIC FISSURE
VASA DEFERENTIA AND VESICULÆ SEMINALES
ANTERIOR WALL OF RECTUM
INTERNAL URINARY MEATUS
CAVITY OF RECTUM WITH FOLD OF KOHLRAUSCH
MUCOUS MEMBRANE OF BLADDER
PERITONEUM
Fascia transversalis
Fat in space of Retzius
SYMPHYSIS
Vesico-pubic muscle
ANTERIOR WALL OF PROSTATE WITH CAPSULE
Dorsal vein of penis
SEPTUM PECTINIFORME
CORPUS SPONGIOSUM URETHRÆ
POSTERIOR WALL OF PROSTATE WITH CAPSULE
Rectal portion of recto-vesical fascia
Sphincter ani
LOWER END OF RECTUM
Sphincter ani
Fascia of Colles
Deep transversus perinæi between superficial and deep triangular ligaments
COWPER'S GLAND
Junction of deep and superficial triangular ligaments with fascia of Colles

FIG. 351.—SAGITTAL SECTION THROUGH THE MALE PELVIS. (Morris)

STRUCTURE of the PENIS.

CORPORA CAVERNOSA — Arise from the anterior & inner part of the two ischiat tuberosities, and from the ascending rami of the ischia & descending rami of the pubes, by two pointed prolongations, the *crura penis*. These pass forwards & inwards, present a slight enlargement, the *bulb of the corpus cavernosum*, and unite to form the body of the penis. – The body of the penis presents on its upper surface a narrow median groove for the dorsal vessels & nerves of the organ, and, on its under surface a broader groove, which receives the corpus spongiosum. It ends anteriorly in a rounded extremity overlapped by the base of the glans.

CORPUS SPONGIOSUM — Commences between the two converging crura of the corpora cavernosa by an expanded portion, the *bulb of the urethra*. This latter is penetrated superiorly by the membranous portion of the urethra, is marked inferiorly by a partial division into two lobes, and is surrounded by the accelerator urinæ muscle & by a prolongation of the anterior or descending layer of the deep perineal fascia. – It passes forwards, as an erectile tube, round the spongy portion of the urethra, and terminates in the *glans penis*, a conical enlargement, which overlaps the anterior rounded extremity of the two corpora cavernosa.

STRUCTURE of the CORPORA CAVERNOSA & SPONGIOSUM — They consist of:

Fibrous Investment – Thick, dense, firm, especially over the corpora cavernosa, highly elastic, but incapable of more than a certain degree of distention; formed of white & yellow elastic fibrous tissues and of unstriped muscular fibres disposed longitudinally in the superficial strata, circularly in the deeper ones.

It forms but an incomplete septum between the two corpora cavernosa in their points of contact: – The septum is thick & imperforate behind, but it only consists in front of a few vertical bands arranged somewhat like the teeth of a comb, and forming the *septum pectiniforme*.

It gives off numerous trabeculæ from its inner surface. – In the corpora cavernosa the trabeculæ are strongest towards the periphery, and the compartments they bound are transversely or circularly disposed & largest towards the centre. In the corpus spongiosum the trabeculæ are more delicate, and the compartments are longitudinal & more uniform, except in the glans penis where their arrangement is somewhat complex.

Erectile Tissue – Consists of afferent arteries, a venous plexus, & efferent veins.

AFFERENT ARTERIES – Are the arteries of the corpora cavernosa & the arteries of the bulb, and twigs from the internal pudic & the dorsal arteries of the penis. Some of the branches of these arteries terminate in capillary plexuses as in other parts of the body. Others, the *helicine arteries*, which are said to be especially numerous towards the root of the penis and to be wanting in the glans, become convoluted, and forming tendril-like twigs, project singly or in tufts into the venous spaces, and end in dilated extremities which are either open or closed (Müller). This is denied however by Valentin, who describes the smallest branches of the arteries as ending in wide funnel-shaped orifices, which open directly into the venous spaces.

VENOUS PLEXUS – Is very intricate. So numerous & large are the communications between the veins that the blood appears to be effused into a system of extra-vascular structures.

EFFERENT VEINS – Some emerge from the corona glandis and from the upper & under surfaces of the corpora cavernosa, and join the dorsal vein of the penis; most pass out at the root of the penis, and join the prostatic plexus & the pudic veins.

The proper nerves of the cavernous structures are derived mainly from the pelvic & prostatic plexuses of the sympathetic, but partly also from the pudic nerve.

INTERNAL ILIAC ARTERY.

Short thick trunk which extends from bifurcation of common iliac artery opposite sacro-vertebral articulation (some Authors say opposite sacro-iliac synchondrosis) to upper border of great sacro-sciatic foramen, near which it divides into anterior & posterior divisions.

Usually 1½ inches long, but its length may vary from ½ an inch to 3 inches.

Rather smaller in adult than the external iliac. Twice as large in fœtus: – Under the name of hypogastric artery, it then continues the common iliac along side of bladder, and ascends to umbilicus where it becomes one of the umbilical arteries.

RELATIONS:

IN FRONT – Peritoneum, ureter.
BEHIND – Pyriformis, internal iliac vein, lumbo-sacral cord.
ON OUTER SIDE NEAR ORIGIN – Psoas & external iliac vein.

BRANCHES — Are given off as follows, from: –

ANT. DIVISION — **Sup. Middle & Inf. Vesical, Middle Hæmorrhoidal,** and in female, **Uterine & Vaginal; Obturator, Sciatic, Pudic.**

POST. DIVISION — **Ilio-Lumbar, Lateral Sacral, Gluteal.**

BRANCHES of the INTERNAL ILIAC ARTERY—1st T.

BRANCHES FROM ANTERIOR DIVISION.

VISCERAL BRANCHES:

Vesical - Two or three; but other twigs pass to bladder from middle hæmorrhoidal, uterine, vaginal, & obturator.

SUPERIOR VESICAL - Is that part of hypogastric artery which extends to side of bladder, and which remains pervious after birth. Gives off *artery of vas deferens*, and the

MIDDLE VESICAL, - Which is often wanting.

INFERIOR VESICAL - Usually arises in common with middle hæmorrhoidal. To base of bladder, prostate, & vesiculæ seminales.

Middle Hæmorrhoidal - Joins with superior hæmorrhoidal branch of inferior mesenteric, and with inferior hæmorrhoidal branch of internal pudic.

Uterine - Downwards to neck of uterus, and then upwards in a tortuous course along side of body between folds of broad ligament; communicates with ovarian.

Vaginal - Descends upon vagina to neck of bladder & rectum.

NON-VISCERAL BRANCHES:

Obturator - Usually arises (2 cases out of 3) from anterior division or sometimes from posterior division of internal iliac. In one case in 3½ it arises from the epigastric, that is to say that its anastomotic branch with that artery is enormously increased in size while its proper root is proportionately diminished. Sometimes both roots are nearly equally developed (1 case in 72). Occasionally the artery arises from termination of external iliac.

In cases of abnormal origin from epigastric the obturator artery usually arises from near the root of the latter, and then descends into the pelvis close to the external iliac vein and on the outer side of the femoral ring. Sometimes, however, it arises from the epigastric higher up, that is to say at a distance from the root of the latter; it then passes inwards above the femoral ring and descends into the pelvis on the inner side of that ring behind Gimberat's ligament. It is in this latter case only that the obturator artery is exposed to be wounded in the operation for strangulated femoral hernia.

When it arises from the internal iliac it passes forwards along outer wall of pelvis below obturator nerve, giving off small iliac & vesical branches and a pubic branch which communicates on back of pubes with its fellow and with the epigastric.

Through upper part of obturator foramen, and divides into:

INTERNAL BR. - Round inner margin of obturator foramen; supplies obturator & adductor muscles, pectineus & gracilis and anastomoses with internal circumflex.

EXTERNAL BR. - Round outer margin of obturator foramen to interval between gemellus inferior & quadratus femoris, sends an articular branch to hip-joint through cotyloid notch, and anastomoses with external circumflex & sciatic arteries; supplies obturator externus & the lower external rotator muscles.

Sciatic - The largest of the two terminal branches of anterior division of internal iliac artery, and the largest branch of the artery after gluteal.

Downwards in front of pyriformis & sacral plexus, lying a little behind & to outer side of internal pudic.

Through great sacro-sciatic foramen below pyriformis and between great sciatic nerve & pudic vessels & nerve.

With small sciatic nerve over gemelli, obturator internus & quadratus femoris and in front of gluteus maximus

Gives off branches:

MUSCULAR, ARTICULAR to hip-joint;

COCCYGEAL, INFERIOR GLUTEAL;

COMES NERVI ISCHIADICI - Long, slender; with, and subsequently within sheath of, great sciatic nerve to lower part of thigh.

Pudic - Vide next Tablet.

BRANCHES of the INTERNAL ILIAC ARTERY—2nd T.

PUDIC ARTERY.

The smaller of the two terminal branches of anterior division of internal iliac artery.

Descends in front of pyriformis & sacral plexus, lying to the inner side & a little in front of sciatic artery

With pudic nerve through lower part of great sacro-sciatic foramen below pyriformis on inner side of sciatic nerves & sciatic artery

Winds round spine of ischium and re-enters pelvis through lesser sacro-sciatic foramen.

Forwards along outer wall of ischio-rectal fossa below pudic nerve, being covered by obturator fascia, and lying at first 1½ inches above lower extremity of tuber ischii, but approaching surface as it progresses

Pierces deep layer of deep perinæal fascia, and ascends along pubic arch between the two layers of that fascia to near symphysis pubis

Pierces superficial layer of deep perinæal fascia, and divides into artery of corpus cavernosum and dorsal artery of penis.

BRANCHES:

Inferior Hæmorrhoidal – Two or three, small. – Arise in ischio-rectal fossa, which they cross to lower part of rectum & anus.

Superficial Perinæal – Arises near transversus perinæi muscle, which it crosses superficially.

Between accelerator urinæ & erector penis to skin of scrotum & dartos, or of labium.

Transverse Perinæal – Small, arises frequently from superficial perinæal.

Inwards below transversus perinæi to structures between bulb and anus

Artery of the Bulb – Large and surgically important.

Inwards to bulb & Cowper's glands between the two layers of deep perinæal fascia

May be small or even absent, or may be double. May arise earlier and cross perinæum further back than usual, and would then be very liable to be divided in lateral lithotomy. May arise from an accessory pudic, and then lie more forward and be altogether out of danger

Artery of the Corpus Cavernosum – Pierces crus penis, and runs forwards in corpus cavernosum by side of septum pectiniforme.

Dorsal Artery of the Penis – Between crus and symphysis. Through suspensory ligament and forwards beneath skin on dorsum of penis to glans & prepuce

ACCESSORY PUDIC ARTERY — Exceptional branch of internal iliac, which exists when pudic artery, being smaller than usual, fails to give off its two terminal branches & sometimes even the artery of the bulb.

Arises from near origin of pudic, passes forwards along base of bladder & upper part of prostate, pierces triangular ligament, and takes the place of terminal portion of normal artery.

FIG. 352. THE GLUTEAL, SCIATIC, AND PUDIC NERVES. (Hirschfeld.)

(1) Superior gluteal nerve; 2, 3, its superior & inferior divisions;
4, nerve to pyriformis.
(5) 6, its inferior gluteal branch; 8, small sciatic nerve;
7, its interior pudendal branch;
9, nerve to obturator internus & gemellus superior.
(10) Pudic nerve; 11, its superficial perinæal branch; 12, dorsal nerve of the penis.
(13) Great sciatic nerve.
a, *a*, gluteus maximus; *b*, *b*, gluteus medius; *c*, gluteus minimus; *d*, tensor vaginæ femoris; *e*, pyriformis partly cut away; *f*, obturator internus & gemelli; *g*, quadratus femoris; *h*, great sacro-sciatic ligament, divided.

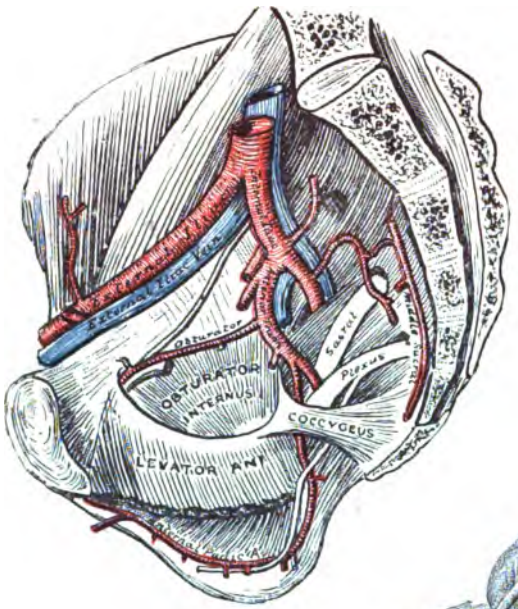


FIG. 353.—ENTIRE COURSE OF PUDIC ARTERY AS SEEN FROM THE INNER SIDE. (After Bourgery & Jacob and Testut.) (See Fig. 357, p. 151a.)

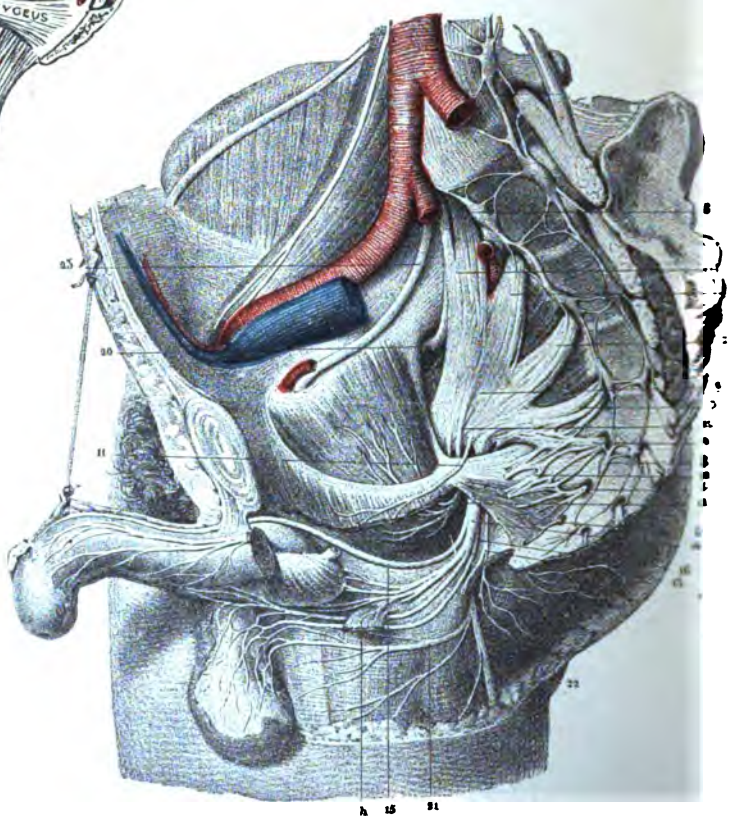


FIG. 354.—SACRAL PLEXUS. (Hirschfeld.)

7, lumbo-sacral cord; 1, 2, 3, 4, 5, the five sacral nerves; 6, the coccygeal nerve; 9, sacral plexus; pudic nerve; 20, superior gluteal nerve; 22, small sciatic nerve; 23, obturator nerve. (See expl.

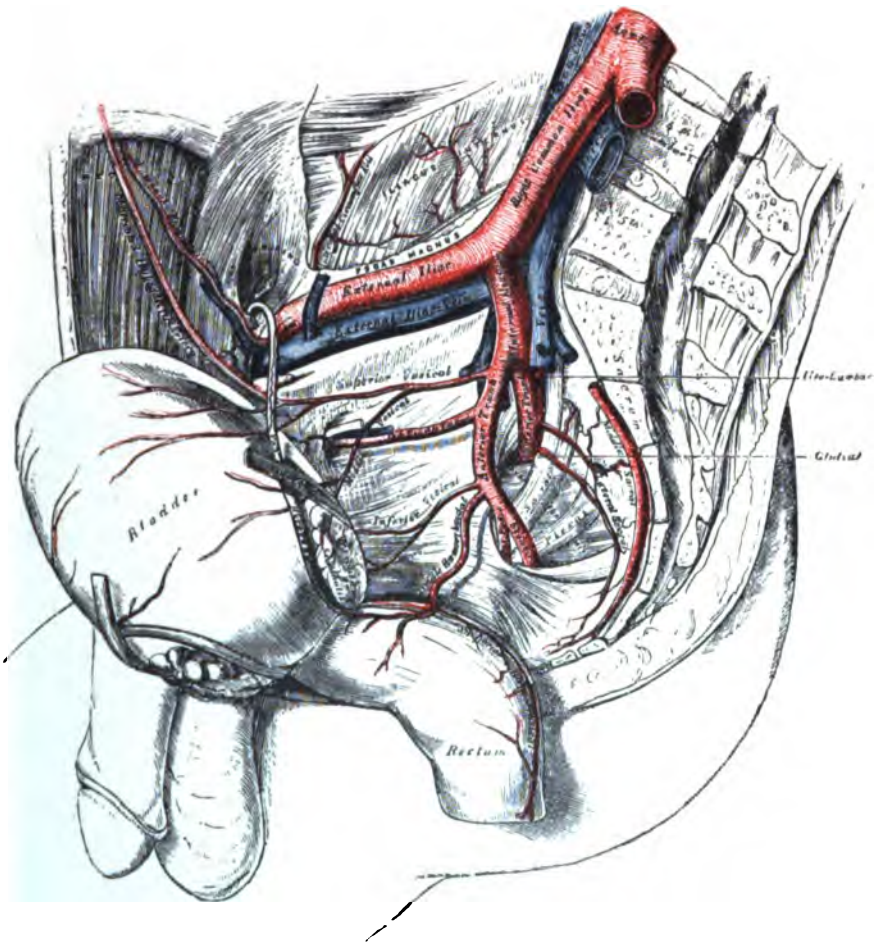


FIG. 355.—THE ARTERIES OF THE PELVIS. (Gray.)

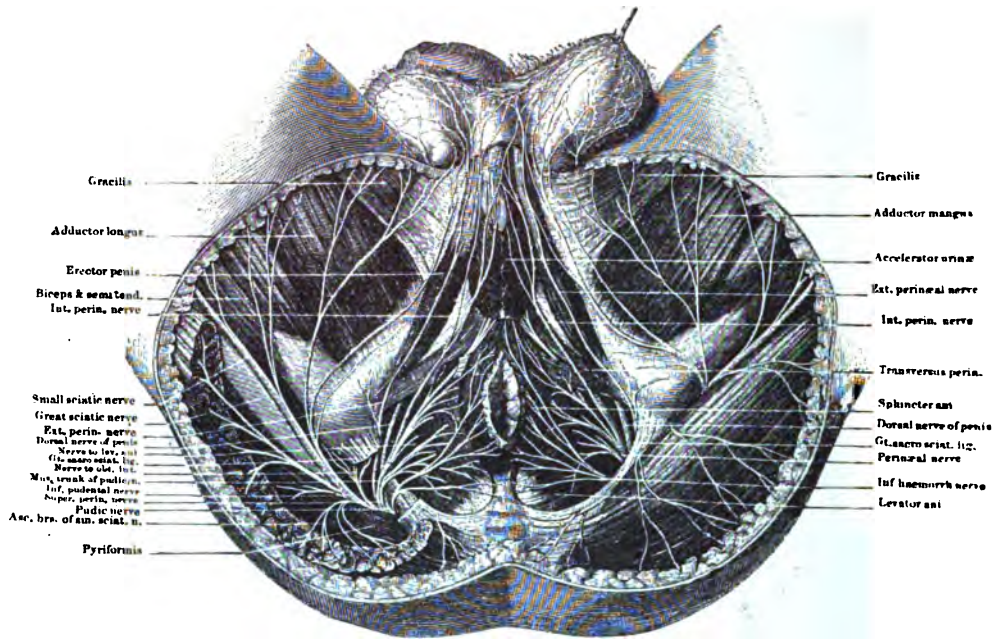


FIG. 356.—THE NERVES OF THE MALE PERINÆUM. (Cruveilhier, Hirschfeld.)

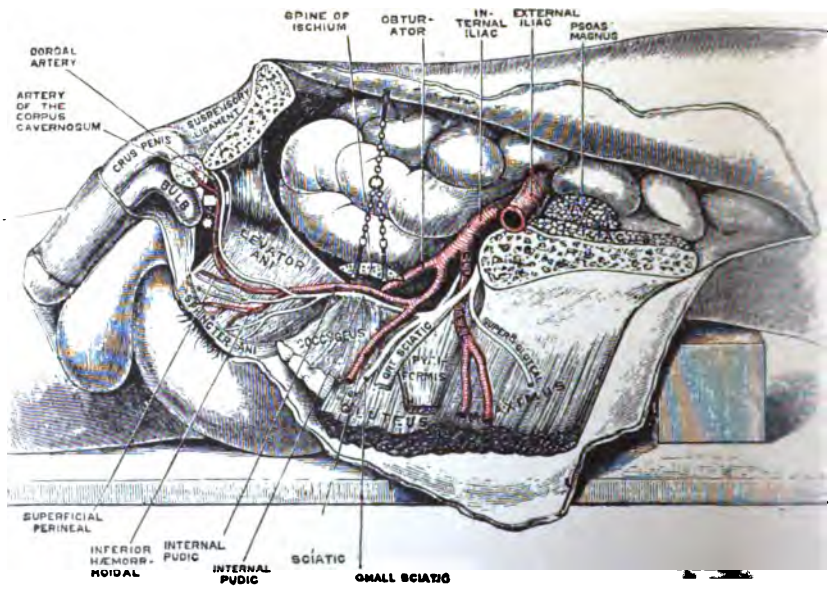


FIG. 357.—ENTIRE COURSE OF PUDIC ARTERY, SEEN FROM OUTER SIDE. (Gray.) (See Fig 238, p. 5

BRANCHES of the INTERNAL ILIAC ARTERY—3rd T.

BRANCHES FROM POSTERIOR DIVISION.

Ilio-Lumbar – Arises from upper part of posterior division.

Ascends beneath psoas to upper part of iliac fossa, where it divides into:

LUMBAR BRANCH – To psoas & quadratus lumborum, communicating with last lumbar artery, and sending a small spinal branch through intervertebral foramen between last lumbar vertebra & sacrum;

ILIAC BRANCH – To iliacus & ilium, and along crest anastomosing with circumflex iliac.

Lateral Sacral – Usually two, superior & inferior.

Downwards and inwards in front of pyriformis & sacral plexus, and along inner side of anterior sacral foramina, anastomosing with middle sacral and giving off

DORSAL BRANCHES – Through anterior sacral foramina to contents of spinal canal, and then through posterior sacral foramina to skin & muscles on back of sacrum.

Gluteal – The largest branch of internal iliac, and the continuation of its posterior division.

Through great sacro-sciatic foramen above pyriformis, and then between latter muscle & gluteus medius, and divides into:

SUPERFICIAL BRANCH – Gives off numerous branches to gluteus maximus & integument over sacrum;

DEEP BRANCH – Forwards between glutei medius & minimus, and divides into:

Superior Division – Along upper border of gluteus minimus towards anterior superior spine of ilium, and joins with circumflex iliac.

Inferior Division – Crosses gluteus minimus towards great trochanter, and joins with ascending branches of external circumflex.

SACRAL PLEXUS.

Formed by lumbo-sacral cord & anterior divisions of the three first sacral nerves, and part of that of the fourth.

Triangular in shape, – its constituent nerve-fibres converging to form one broad flat cord, which leaves pelvis through lower part of great sacro-sciatic foramen below pyriformis, and immediately divides into Small sciatic, Great sciatic & Pudic.

Rests upon pyriformis, and is covered by the pelvic fascia & by the two terminal branches (sciatic & pudic) of anterior division of internal iliac artery.

BRANCHES :

1. **Superior Gluteal** – From back of lumbo-sacral cord.
   With gluteal vessels through upper part of great sacro-sciatic foramen above pyriformis, and divides into:
   SUPERIOR BRANCH – Along middle curved line on dorsum ilii with superior division of deep branch of gluteal artery. Supplies glutei medius & minimus.
   INFERIOR BRANCH – Directly forwards between glutei medius & minimus, which it also supplies, and terminates in tensor vaginæ femoris.

2. **Muscular** – To pyriformis, obturator internus, gemelli & quadratus femoris. – The nerve to obturator internus passes behind spine of ischium and through lesser sacro-sciatic foramen to inner surface of the muscle. – The gemellus inferior and the quadratus femoris are supplied by a common branch, which runs between capsule of hip-joint and the obturator internus & gemelli, and gives off an articular filament to the joint.

3. **Small Sciatic** – From lower & back part of sacral plexus.
   With sciatic vessels through lower part of great sacro-sciatic foramen below pyriformis.
   Descends beneath gluteus maximus on inner side of great sciatic nerve.
   Along back of thigh beneath fascia lata to lower part of popliteal space.
   Perforates deep fascia, and accompanies external saphenous vein to skin of back of leg; communicates with external saphenous nerve. Gives off branches:
   ~~INFERIOR GLUTEAL~~ – Several, large; to under surface of gluteus maximus.
   INFERIOR PUDENDAL – Forwards below tuber ischii to skin of perinæum and upper & inner part of thigh, and to scrotum or labium.
   CUTANEOUS – *Descending.* To skin of inner & outer sides of back of thigh, popliteal space and back of leg.
   Ascending. Wind round lower border of gluteus maximus to integument over its surface.

4. **Great Sciatic** – Vide p. 78.

5. **Pudic** – Vide pp. 107 & 293.

6.

7.

NOTES ON THE NEWER MATTER.

Omega Loop of the Colon, and Rectum.

Some well-known anatomists, and among these Mr. Treves, who has paid special attention to the anatomy of abdomen, would limit the appellation "rectum" to the two lower portions of the structure as usually described, and would join the first portion of the canal to the lower part of the sigmoid flexure to form the "Omega loop of the colon."

According to the view above referred to the descending colon would pass down, not simply to the crest of the ilium, but to the left iliac fossa just external to the psoas; here would begin the Omega loop, which would extend as far as the middle of the third piece of the sacrum. The rectum would begin at the latter point, – and not at the left sacro-iliac synchondrosis, – and would thus be reduced to the portion of the gut which is free from peritoneal investment, except quite at its upper part. This harmonises with the developmental processes already referred to.

After crossing the psoas, the Omega loop either traverses the cavity of the pelvis obliquely, or else descends along its left wall, sometimes reaching its floor, and then passes horizontally to the right; on reaching the right wall of the pelvis, it again inclines to the left to end, as above stated, opposite the middle of the third piece of the sacrum.

If the reader will take the trouble to look at the arrangement of the parts on the dead body, he will see that the shifting figure of the large intestine in this situation is more that of a **S** than an ω. Nevertheless, there is some advantage, from a surgical point of view, in restricting the term "Rectum" to such part of the gut as is free from peritoneal investment.

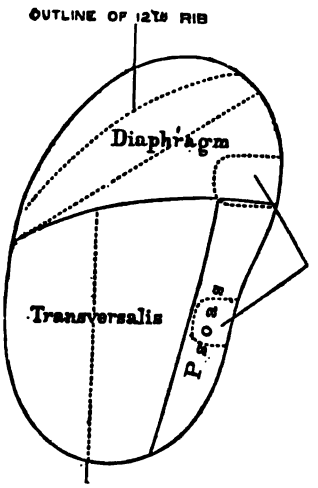
The new description should involve a remodelling of the description of the pelvic peritoneum, – the terms "*recto*-vesical" and "*recto*-vaginal" fossæ no longer applying correctly.

(See further limitation of the rectum by the description of the *Anal canal*, p. 132k.)

Relations of the Kidney.

"The *posterior surface*, with the corresponding portion of the fatty capsule, rests against the posterior abdominal wall in front of the eleventh and twelfth ribs, and the transverse processes of the first and second lumbar vertebræ; the left kidney usually reaching as high as the upper border of the eleventh rib, the right only to its lower border. The only visceral relation posteriorly is on the left side, where the spleen slightly overlaps the kidney, opposite the upper half of its outer border. The parietal relations on both sides are as follows: – [1] the diaphragm; [2] the anterior lamella of the posterior aponeurosis of the transversalis (separating the organ from the quadratus lumborum); [3] the psoas; [4] the three fasciæ – diaphragmatic, transversalis, and iliac – which line these muscles respectively; and [5] the last thoracic, the ilio-hypogastric, and the ilio-inguinal nerves, and the anterior division of the first and second

lumbar vessels, all running obliquely downwards and outwards in front of the quadratus lumborum. Owing to the higher level of the left kidney, its diaphragmatic area of contact is larger than that of the right organ. This area, moreover, may be increased on



Line indicating outer border of quadratus lumborum.

FIG. 357A.—POSTERIOR RELATIONS OF THE KIDNEY. (Anderson, Morris.)

either side when the arcuate ligaments, which give origin to a large portion of the posterior fibres of the diaphragm, are attached to the tip of the transverse process of the second lumbar vertebræ instead of that of the first."

"The pleura has an indirect but important relation to the kidney. The inferior limit of the pleural sac extends almost horizontally outwards from the lower border of the twelfth thoracic vertebra, crossing the last rib near its neck, and the eleventh rib about two inches farther outwards. As a rule, the incision in renal operations may be carried safely to the lower border of the last rib; but should this bone be absent or very short, the eleventh rib may be mistaken for it, and the serous membrane would then be in danger. It is probable, too, that the pleura reaches to a lower point in those cases where the arcuate ligaments are attached to the second lumbar transverse process. The presence of a thirteenth rib would involve a contraction of the space available for surgical exploration of the organ."

"The *upper extremity* of each kidney is crowned by the supra-renal body, which encroaches also upon its anterior surface and inner border, and is fixed to it by connective tissue derived from the subperitoneal fascia."

"The *anterior or visceral surface* is differently related on the two sides. The *right* kidney is in contact in about its upper half with the renal impression on the liver, and below with the ascending colon and duodenum, – the hepatic area being covered with peritoneum, while the second stage of the duodenum and more externally the ascending

colon are directly attached to the surface by subperitoneal tissue; but the two non-peritoneal areas vary considerably in their relative proportions, not only in different subjects, but in the same subject under different conditions of distension of the duodenum

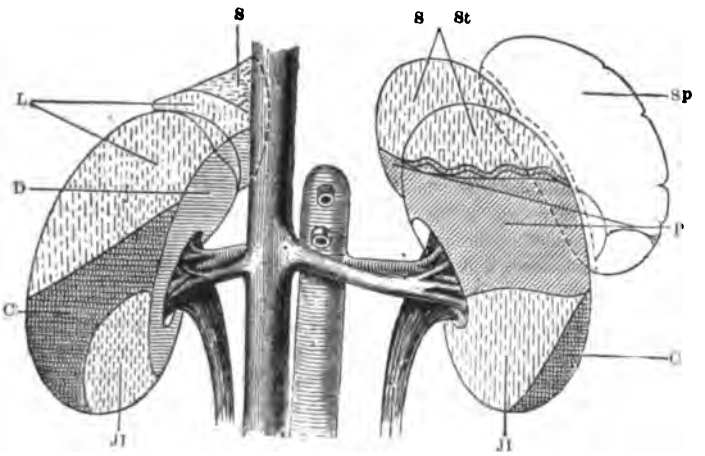


FIG. 357B.—ANTERIOR RELATIONS OF THE KIDNEYS. (Morris.)

In both kidneys: S, suprarenal capsule; C, colon; JI, jejuno-ilium. In right kidney: L, liver D, duodenum. In left kidney: St, stomach; Sp, spleen; P, pancreas.

and colon. The second stage of the duodenum duodenum is also more or less in relation with the right renal vessels. The *left* kidney lies behind the stomach, the pancreas, the splenic vessels, the descending colon, and the colic vessels. Its anterior surface may be divided into three portions: an *upper* or *gastric area*, separated from the stomach by the peritoneum of the lesser sac; a *middle* or *pancreatic area*, attached to the pancreas by subperitoneal connective tissue, and crossed also by the splenic vein where this vessel lies behind the upper border of the gland, and by the splenic artery, which runs in a serpentine course immediately above the vein; and an *inferior* or *colic area*, the outer portion of which is covered by the splenic flexure and the upper part of the descending colon; the inner by the peritoneum of the greater sac and the colic vessels."

"The *outer border* of the kidney reaches a point about three-and-a-half or four inches external to the lumbar spinous process. On the right side it is in contact with the liver in its upper half or two-thirds; on the left its upper third or half rests against the renal groove in the posterior portion of the visceral surface of the spleen."

"The *inner border* of the right kidney lies close to the vena cava, especially above; that of the left is divided from the aorta by an interval of an inch or more." (W. Anderson, in Morris' Anatomy.)

The Bladder.

"The form of the empty bladder is still doubtful, as the appearances in the dead subject do not necessarily coincide with the condition existing during life. In

mesial sagittal section it usually appears somewhat cup-shaped, its upper wall presenting a rounded or pyramidal hollow to the intestine, while its cavity is represented by a T or Y-shaped fissure. It is possible that this "diastolic" form, as it has been termed, is the normal result of the relaxation preliminary to refilling; but it appears more probable that it is due to the loss of vital elasticity of the muscular wall, and that the healthy living bladder always maintains a rounded or ovoid form."

"The three terms, 'apex' or 'superior fundus,' 'inferior fundus,' and 'neck,' are commonly applied to parts of the bladder: the first to the point of attachment of the superior ligament or urachus, which connects it with the umbilicus; the second to the lower part of the organ, and the third to the point at which the vesical cavity becomes continuous with the urethra; but the expressions are more or less objectionable, and serve no useful purpose. Under ordinary distention the so-called apex is as much rounded as the rest of the viscus; the anatomical limits of the 'inferior fundus' are still undefined; and the only 'neck' that can be assigned to the bladder is represented by the prostate and prostatic urethra."

"The bladder, when moderately filled, may be said to present for description five aspects or surfaces; antero-inferior or pubic, posterior or rectal, superior or intestinal, and two lateral or obturator surfaces. The anterior, posterior, and lateral surfaces meet above at the urachus, and converge below towards the base of the prostate – the posterior wall sometimes approaching the urethral orifice almost in a vertical direction, or curving first downwards and then forwards; and in old subjects this curve may be so exaggerated that a kind of pouch is formed behind the internal meatus. The *antero-inferior surface* looks downwards and forwards towards the symphysis. It is uncovered by the peritoneum, but has a strong investment of recto-vesical fascia, and is separated from the pubic bones and anterior attachments of the obturatores interni and levatores ani by a space known as the Cavum Retzii, which contains a variable quantity

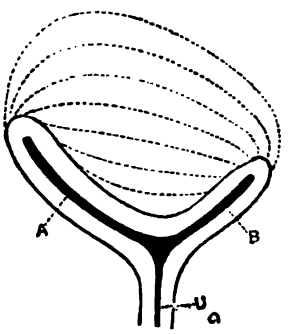


FIG. 357C.—THE SHAPE OF THE BLADDER, AS MADE OUT BY RECENT INVESTIGATION. (Symington, Quain.)

The heavy black line represents the cavity, and the thin black line the boundaries of the empty viscus, which is thus seen to present an upper concave surface, and two limbs, A & B. The dotted lines represent the shape of the organ in its various degrees of distention.

of loose fat continuous with the pelvic and abdominal subperitoneal tissue. Each *lateral surface* is covered by peritoneum down to the level of the line extending from the urachus backwards to a point below the summit of the vesicula seminalis, about

an inch above the base of the prostate. Below this level it is separated from the levatores ani by superitoneal tissue, which usually bears much fat in its meshes and ensheathes the vesical vessels and nerves; and it is crossed by the vas deferens, and at the point of peritoneal reflexion by the obliterated hypogastric artery. The ureter pierces the junction of the posterior and lateral surfaces about two inches above the prostate, the vas running between it and the vesical wall. External to these structures the lateral wall is in relation to the levator ani and obturator internus. The *posterior surface* may be divided into two portions, an upper covered by the peritoneum of the recto-vesical or utero-vesical pouch, a lower in direct contact with the anterior wall of the rectum, and the lower part of the vasa deferentia and vesiculæ seminales. The distance of the recto-vesical cul-de-sac of peritoneum from the prostate is very variable, but usually ranges between half an inch and one inch, and may be increased to two inches by distension of the bladder. It is, however, very small in the child. The ureters, where they lie at the outer limits of this surface, are near to, though not in contact with, the rectum, and a calculus in the lower end of the urinary tube might be felt by an exploration from within the bowel. In the lower portion of the posterior wall in the male is a triangular space, the sides of which are formed by the diverging vasa deferentia, the base by the line of reflexion of the recto-vesical pouch of peritoneum, and the apex by the meeting of the ejaculatory ducts at the summit of the prostate. It was formerly selected as the position for the introduction of a trocar through the rectum into the bladder in case of retention of urine. *In the female* the posterior surface is adherent below to the cervix uteri and upper part of the anterior wall of the vagina, but is separated from the body of the uterus by a shallow utero-vesical pouch of peritoneum. The *superior surface* is entirely covered by peritoneum. It looks almost directly upwards into the abdominal cavity, and lies in contact with the small intestines, and sometimes with a portion of the sigmoid flexure behind these." (W. Anderson, in Morris' Anatomy.)

"Sacral and Coccygeal Aortæ."

On reaching the intervertebral disc between the fourth and fifth lumbar vertebræ the Aorta gives off the two common iliacs, and, suddenly diminishing in size, is continued, under the above name, along the middle line of the sacrum and coccyx. The vessel terminates by piercing the floor of the pelvis to end in the coccygeal glomerulus, or Lushka's gland. This is a convoluted mass of small arteries with varicose dilatations, representing the termination of the aorta with the last of its metameric branches, which latter, as the tail disappeared, have become degenerated and functionless. (Macalister.)

The internal iliac artery is the root, and the superior vesical artery is the middle part, of the umbilical, or allantoic, artery of the fœtus, which, beyond the bladder, becomes reduced to a mere fibrous cord.

Together the following arteries, namely, common iliac, upper part of internal iliac, superior vesical, and obliterated hypogastric, represent the allantoic or umbilical artery of the fœtus. The allantoic or umbilical arteries, which were given off from the two dorsal aortæ before their fusion, give off to the lower limbs, when these are formed, two large lateral branches, which become the external iliacs. Further on they give off

to the pelvic viscera two large branches, which become the *lower part* of the internal iliacs. Further on they contract into the two superior vesical arteries. Further on still they become entirely closed, and form the obliterated hypogastric arteries.

The arteries of the several metameres originally divided into branches mesial, lateral, and parietal. The *mesial branches* supplied the alimentary canal, and became the superior and inferior mesenteric, and the smaller œsophageal branches of the aorta and cœliac axis. The *lateral branches* supplied the intermediate cell mass, and became the phrenic, supra-renal, renal, and spermatic or ovarian; the original arrangement of these arteries has become almost lost, and in many cases a single artery, *e.g.*, the renal, represents several originally distinct vessels sometimes imperfectly fused into one. The *parietal branches* supplied the walls of the body cavity, and became the intercostal and lumbar arteries, in which the metameric arrangement is still distinct. These arteries divided into ventral and dorsal branches which need not be specially referred to here, except in connection with their longitudinal anastomoses. Their ventral or terminal longitudinal anastomoses gave rise to the internal mammary, and superior and deep epigastric arteries. Their dorsal longitudinal anastomoses gave rise to the arteries that run own the front and back of the spinal cord.

Rectal and Urogenital Triangles, and the Abdominal & Perinæal Fasciæ.

The appropriate terms, *Rectal* and *Urogenital triangles*, are applied by Professor Cunningham to the posterior and anterior halves respectively of the perinæal space.

By the same authority the designations, *fascia of Camper* and *fascia of Scarpa*, are applied to the superficial and deep layers of the superficial fascia of the abdomen; and the revived designation, *fascia of Colles*, to the deep layer of the superficial fascia of the perinæum, or superficial perinæal fascia.

Camper's fascia is a fatty layer directly continuous with the superficial fascia of the surrounding regions. *Scarpa's fascia* is a membranous layer without fat, and containing a good deal of elastic tissue; in the lower part of the abdomen, this tissue is collected into a distinct band over the lower part of the linea alba.

If the whole thickness of the superficial fascia of the abdomen, – that is, both its layers, or Camper's and Scarpa's fasciæ, – be divided down to the aponeurosis of the external oblique muscle in the lower part of the abdomen, it will be found that the fingers can be passed down towards the thigh beneath these layers, – that is, between Scarpa's fascia and the aponeurosis of the external oblique, – to a little below Poupart's ligament only. Here Scarpa's fascia blends with the fascia lata of the thigh. Towards the pubes, however, the finger can be passed behind Scarpa's fascia and the spermatic cord into the perinæum, where Scarpa's fascia becomes continuous with Colles' fascia. (Cunningham.)

A method is devised by Professor Cunningham for inflating the superficial perinæal space, or the pouch comprised between Colles' fascia and the superficial layer of the deep perinæal fascia or triangular ligament: A longitudinal incision being made into the back part of Colles' fascia a little to one side of the middle line, and the bellows being introduced, inflation is first limited to the corresponding side of the pouch; but, on reaching the scrotum, where the median septum is incomplete, the air forces its way across the middle line, and inflates the pouch of the opposite side. Of course the air cannot pass either into the rectal triangle or down the thighs, on account of the attach-

ments already described; but, after a time, it forces its way forwards under the superficial fascia and dartos to the scrotum and penis, and then beneath the spermatic cord and Scarpa's fascia on to the anterior aspect of the abdomen. (Cunningham.)

The inferior layer of the deep perineal fascia or triangular ligament Professor Cunningham considers as lying in the same morphological plane as the bony wall of the pelvis and the thyroid membrane. The deep layer he considers as a part of the pelvic fascia.

DEVELOPMENT OF THE GENITO-URINARY ORGANS.*

Order of Succession of the Segmental Organs and their Ducts. Derivatives of the latter.

I. – Wolffian or Mesonephrotic Duct, to which is subsequently added the Wolffian Body or Mesonephros:—

In the Male: Epididymis, Vas deferens, Ejaculatory duct; Vesicula seminalis.

In the Female: Duct of Gärtner.

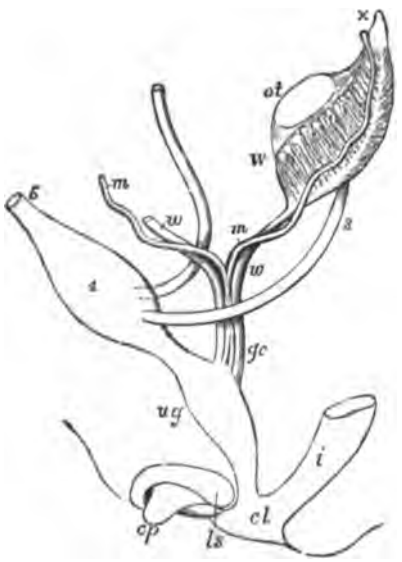


FIG 357D.—DIAGRAM OF THE PRIMITIVE URO-GENITAL ORGANS IN THE EMBRYO PREVIOUS TO SEXUAL DISTINCTION. (Allen Thomson, Quain.)

s, ureter; *b*, urinary bladder; *δ*, urachus; *o.t.*, the genital ridge from which either the ovary or testicle is formed; *W.*, left Wolffian body; *w.w.*, right and left Wolffian ducts; *m.m.*, right and left Müllerian ducts uniting together and running with the Wolffian ducts in *g.c.*, the genital cord; *u.g.*, sinus urogenitalis; *i.*, lower part of the intestine; *cl.*, cloaca; *e.p.*, elevation which becomes clitoris or penis; *l.s.*, fold of integument from which the labia majora and scrotum are formed.

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* It will be seen that this subject is treated entirely from the point of view of Macroscopical Embryology, as defined in the preface to the 10th thousand. Histological details have been entirely omitted.

II. – Müller's Duct, or Pronephrotic Duct, to which is subsequently added in many lower animals, but not in man, the Pronephros:—
In the Female: Fallopian Tube, Uterus, Vagina.
In the Male: Sinus pocularis; Hydadid of Morgagni.

III. – Metanephrotic Duct, and Metanephros:—
In both Sexes: Ureter and Permanent Kidney.

The above structures are derived from the intermediate cell mass or common reproductive cell mass, so called because it is comprised between the protovertebræ and the point of division of the mesoblast into somatopleure and splanchnopleure, and because it is the common source from which there are developed, as far as mesoblastic elements are concerned, the central genito-urinary organs of both male and female.

Mesonephros, or Wolffian Body, and Duct.

The duct is the part first formed. It appears as a solid cord in the upper part of the intermediate cell mass just below the epiblast, sinks downwards towards the pleuro-peritoneal cavity, becomes hollow, and opens into the uro-genital sinus. The secreting tubules join its inner aspect. They take a wavy course upwards and inwards, and end in dilated extremities, which soon contain vascular tufts or glomeruli similar to those of the future kidney.

The Wolffian Body degenerates in both sexes. In the female it forms the parovarium or organ of Rosenmüller. In the male it forms the rete testis, vasa efferentia, and coni vasculosa, – and also the vas aberrans and organ of Giraldes. The Wolffian duct becomes, as above stated, in the male, the epididymis, vas deferens, and ejaculatory duct, – from which latter the vesicula seminalis is given off as an evaginating pouch, – and, in the female, the duct of Gärtner.

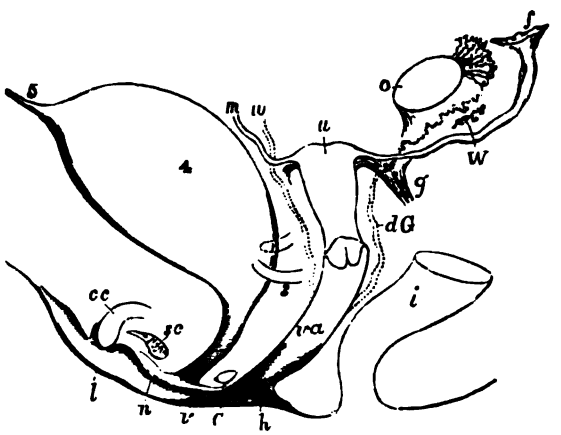


FIG. 357E.—DIAGRAM OF THE FEMALE TYPE OF SEXUAL ORGANS. (Allen Thomson, Quain.)

o., left ovary; *p.o.*, parovarium [epoophoron of Waldeyer]; *W.*, scattered remains of Wolffian tubes near it [paroophoron of Waldeyer]; *d.G.*, remains of the left Wolffian duct, such as give rise to the duct of Gärtner represented by dotted lines; that of the right side is marked *W.*; *f.*, the abdominal opening of the left Fallopian tube; *u.*, uterus; the Fallopian tube of the right side is marked *m.*; *g.*, round ligament corresponding to the gubernaculum; *i.*, lower part of the intestine; *v.a.*, vagina; *h.*, situation of the hymen; *C.*, gland of Bartholin [Cowper's gland], and immediately above it the urethra; *c.c.*, corpus cavernosum clitoridis; *s.c.*, vascular bulb or corpus spongiosum; *n.*, nympha; *l.*, labium; *v.* vulva.

Pronephros, and Müller's Duct.

The peritoneum covering the intermediate cell mass becomes thickened and columnar in two situations, – on the inner side, where the thickening gives rise to the germinal ridge, and on its outer side, where, by a process of involution, the Müllerian duct is formed. This duct develops from before backwards, and opens into the uro-genital sinus between and above the Wolffian ducts. The corresponding glandular structure, or pronephros, develops in many of the lower animals, but not in man.

Müller's duct forms in the female the Fallopian tube, uterus and vagina, and, in the male, the sinus pocularis and the hydadid of Morgagni. It is not the pronephros, as formerly believed, but the Wolffian Body, as above stated, which in the male becomes the rete testes, vasa efferentia, and coni vasculosa, and thus connects in the male the central genital gland, or testicle, to the vas deferens.

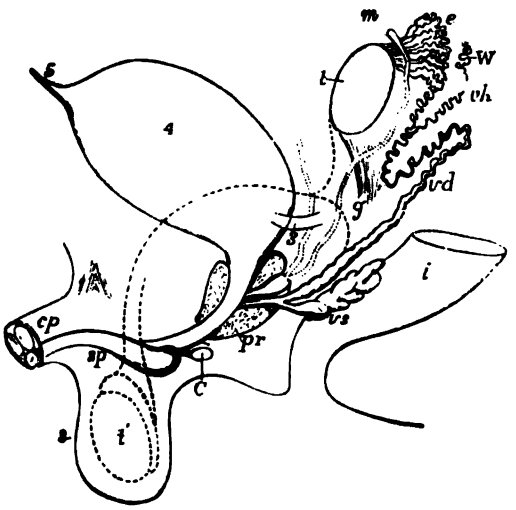


FIG. 357F.—DIAGRAM OF THE MALE TYPE OF SEXUAL ORGANS. (Allen Thomson, Quain.)

t., testicle in the place of its original formation ; *e.*, caput epididymis ; *v.d.*, vas deferens ; *W.*, scattered remains of the Wolffian body, constituting the organ of Giraldes, or the paradidymis of Waldeyer ; *v.h.*, vas aberrans ; *m.*, Müllerian duct, the upper part of which remains as the hydatid of Morgagni, the lower part, represented by a dotted line descending to the prostatic vesicle, constitutes the occasionally existing cornu and tube of the uterus masculinus ; *g.*, the gubernaculum ; *v.s.*, the vesicula seminalis ; *pr.*, the prostate gland ; *C.*, Cowper's gland of one side ; *c.p.*, corpora cavernosa penis cut short ; *s.p.*, corpus spongiosum urethræ ; *s.*, scrotum ; *t'.*, together with the dotted lines above, indicate the direction in which the testicle and epididymis descend from the abdomen into the scrotum.

Metanephros and Ureter.

The first structure to appear is a diverticulum from the lower and back part of the Wolffian duct. This is the ureter. Smaller tubes converge towards the ureter from the intermediate cell mass, become convoluted, and form the tubuli uriniferi, whose dilated extremities soon contain the Malpighian tufts or glomeruli.

Central Genital Gland: - Testicle or Ovary.

Is evolved in the situation of the pronephros: - The cells of the intermediate cell mass supply the mesoblastic elements; the cells of the germinal ridge supply the hypoblastic elements, and become the spermatoblasts or the ova. The tubuli seminiferi are at first solid. They hollow out, lengthen and branch, and open into the vas deferens by means of the rete, vasa efferentia, and coni vasculosi.

Genital Cord.

The genital cord is the common bundle formed by the approximation of the Wolffian and Müllerian ducts a little above their entrance into the uro-genital sinus.

The Müllerian ducts lie between and behind the Wolffian ducts: they unite into one canal before they open into the sinus. In the female, the common canal thus formed becomes the vagina, cervix, and greater part of the body of the uterus.

The portions of the Müllerian ducts immediately above this become the cornua of the uterus. The remainder of the Müllerian ducts become the Fallopian tubes, which are joined on to the ovaries.

The thickening of the walls of the uterus begins at the os, and progresses from below upwards: for some time after birth the cervix is larger and thicker than the body.

Incomplete union of the Müllerian ducts gives rise to the uterus bicornis or horned uterus, common to many mammals; their imperfect union may give rise to a double uterus, and even, occasionally, to a similarly partitioned vagina.

The Müllerian ducts being formed by an involution of the peritoneum, the female passages and their mucous membrane are continuous with the peritoneal cavity and its epithelial lining.

In the male, the united portions of the Müllerian ducts become the sinus pocularis or vesicula prostatica.

The Wolffian ducts open into the uro-genital sinus, as already stated, on either side of and below the Müllerian ducts. In the male they become the canal of the epididymis, vas deferens, and ejaculatory duct, diverticula from their walls forming the vesiculæ seminales.

The prostate in the male results from the thickening of the lower part of the genital cord.

It will be seen that the excretory ducts of the male and female organs are evolved, - those of the male from the Wolffian duct, and those of the female from the Müllerian duct, - the non-evolving duct disappearing more or less completely in either sex. The non-evolving or imperfectly evolving Wolffian body similarly disappears more or less completely in both sexes.

Residual Genito-Urinary Organs of both Sexes.

Residual genito-urinary organs result in both sexes from certain remains of the Wolffian body, - and further, in the male, from certain remains of the Müllerian duct, and, in the female, from certain remains of the Wolffian duct.

The remains of the *Wolffian body* are, in the male, the *Vas aberrans* and the *Organ of Giraldes*, and, in the female, the Parovarium or Organ of Rosenmüller. The remains of the *Müllerian duct* are the *sinus pocularis* and the *hydadid of Morgagni* in the male. The remains of the *Wolffian duct* form the *Canal of Gärtner* in the female.

The Urinary Bladder

Is formed from the intra-fœtal portion of the allantois.

It is at first an elongated fusiform sac opening, on the one hand, into the cavity of the allantois, and, on the other, into the cloaca, or common outlet of the digestive, urinary, and reproductive tracts.

It contracts superiorly into a fibrous cord, the urachus, by which it remains permanently connected to the umbilicus.

Inferiorly it becomes separated from the intestinal canal by a transverse septum, the perinæum.

It then forms part of the uro-genital sinus, which sinus forms the female urethra, and the membranous and prostatic portions of the male.

The External Genito-Urinary Organs.

Appear a little after the internal, and are identical at first in both sexes.

They consist at first of a rounded eminence, the genital tubercle, on which appears a median depression or groove, the genital furrow.

This furrow deepens, and opens into the cloaca, or common outlet, as aforesaid, of the intestinal canal and of the internal genito-urinary organs.

A transverse septum, the perinæum, now separates the rectum from the uro-genital sinus, and the anus from the external genitals.

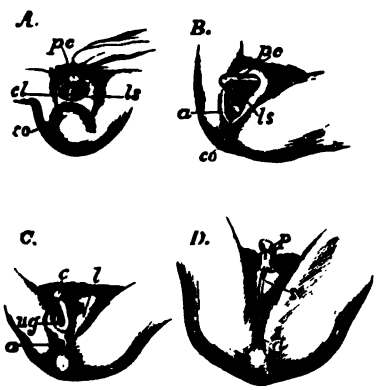


FIG. 357G.—DEVELOPMENT OF THE EXTERNAL SEXUAL ORGANS IN THE MALE AND FEMALE FROM THE INDIFFERENT TYPE. (SCHER.)

A., the external sexual organs in an embryo of about nine weeks, in which the external sexual distinction is not yet established, and the cloaca still exists; *B.*, the same in an embryo somewhat more advanced, and in which, without marked sexual distinction, the anus is now separated from the uro-genital aperture; *C.*, the same in an embryo of about ten weeks, showing the female type; *D.*, the same in a male embryo somewhat more advanced. Throughout the figures the following indications are employed:—*p.c.*, sexual eminence [penis or clitoris]; to the right of these letters in *A.*, the umbilical cord; *p.*, penis; *c.*, clitoris; *cl.*, cloaca; *ug.*, urogenital opening; *a.*, anus; *l.s.*, cutaneous elevation which becomes labium or scrotum; *l.*, labium; *s.*, scrotum; *co.*, caudal or coccygeal elevation.

The uro-genital sinus is the lowest and contracted part of the intra-fœtal portion of the allantois. It communicates superiorly with the urinary bladder. Into it open,

first the Wolffian ducts, and then the ureters and the Müllerian ducts. It subsequently contracts to form the female urethra, and the prostatic and membranous portions of the male urethra.

The growth of the uterus and vagina separates, in the female, the genital canal from the urinary.

Sexual differentiations now appear externally:—

Two elongated and obliquely disposed eminences are formed on either side and in front of the uro-genital opening. They converge anteriorly to form, in the male, the corpora spongiosum and cavernosa, in the female, the clitoris and the labia minora; a slit or groove remaining for a time on the under surface of the former.

In the male, the corpora cavernosa and spongiosum extend upwards. The lower margins of the latter soon join, closing the median groove inferiorly, and forming the spongy portion of the urethra In the female, the clitoris tends to bend downwards.

Two cutaneous appendages appear on either side. In the female, they remain separate as the labia majora. In the male, they join from behind forwards to form the scrotum, into which the testicle descends at birth.

EXPLANATION OF FIGURES NOT FULLY EXPLAINED IN THE TEXT.

(PELVIS.)

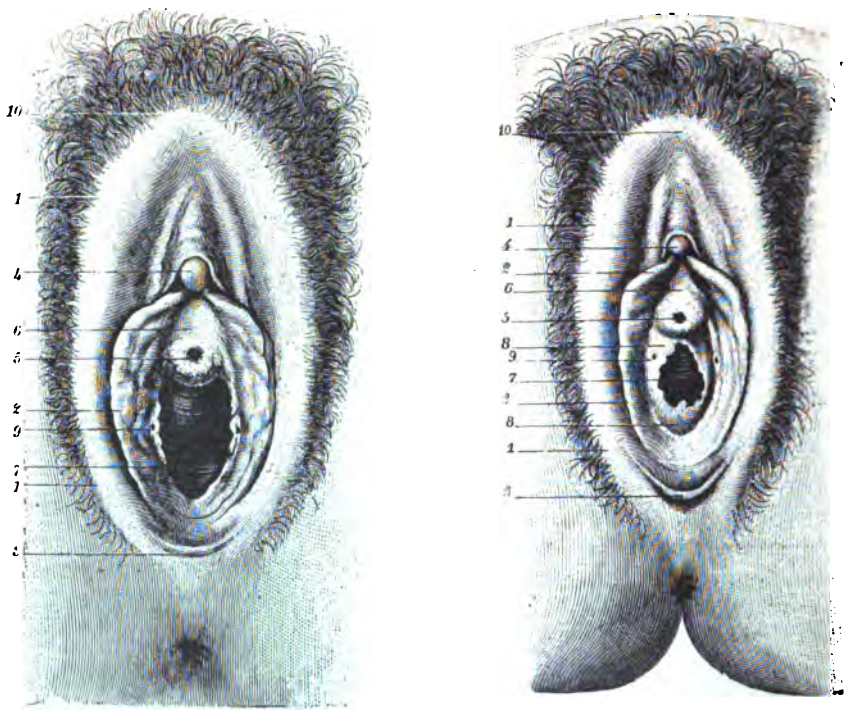
FIG. 331.—SAGITTAL SECTION THROUGH MALE PELVIS. (Sappey.)

1, 2, 3, 4, upper, middle, and lower portions of rectum; 5, 6, 8, body, apex, and base of bladder; 10, recto-vesical cul-de-sac; 11, opening of ureter; 12, vesicula seminalis, with vas deferens on its inner side; 13, 14, prostate behind and in front of urethra; 16, 17, membranous and spongy portions of urethra; 18, corpus spongiosum; 19, septum scroti.

FIG. 346.—THE VISCERA OF THE MALE PELVIS SEEN FROM THE RIGHT SIDE. (Wilson.)

3, bladder; 5, base of bladder; 6, ureter; 8, pelvic fascia; 9, prostate gland; 10, membranous portion of urethra; 11, triangular ligament; 12, Cowper's gland; 13, bulb; 14, corpus spongiosum; 15, crus penis; 16, sigmoid flexure and upper part of rectum; 17, recto-vesical fold of peritoneum; 18, second portion of rectum; 19, vesicula seminalis; 20, vas deferens; 21, pelvic fascia covering lower part of rectum 22, levator ani muscle, divided; 23, sphincter ani.

FEMALE GENITO-URINARY ORGANS.



FIGS. 357A & B.—THE PUDENDUM : A, IN THE VIRGIN ; B, IN THE MULTIPARA. (Sappey.)

1, 2, 3, labia majora and minora, and fourchette ; 4. clitoris ; 5, meatus urinarius ; 6, 7, 8, vestibule and vaginal orifice, and hymen (in the virgin) ; 9, opening of duct of vulvo-vaginal glands ; 10, mons veneris.

THE PUDENDUM.

Comprises all the external genitals of the female, i.e.; -

Mons Veneris - Rounded eminence in front of pubes, formed by a collection of adipose tissue, and covered with hair after puberty.

Labia Majora - Two prominent folds, thickest in front, formed externally of integument, internally of mucous membrane, and containing a large quantity of areolar & dartoic tissues, which folds are joined together at the mons Veneris, where they form the *anterior commissure*, and also in front of the perinæum proper, where they form the *posterior commissure* and bound posteriorly the *fossa navicularis*, which latter fossa is bounded anteriorly by the *fourchette*

Labia Minora or Nymphæ - Two small folds of mucous membrane, narrow inferiorly, where they become lost on inner surface of foregoing, broad superiorly, where, dividing, they embrace, and form the *prepuce* of, the

Clitoris - A diminutive penis in appearance & structure, presenting crura, body, glans, prepuce, suspensory ligament, & muscles analagous to those of the male, but no urethra, the female urethra being imbedded in the anterior wall of the vagina, and its

Meatus Urinarius - Lying somewhat prominently about an inch below clitoris, at lower part of vestibule.

Vestibule - A triangular depression bounded laterally by the nymphæ and inferiorly by the

Aperture of the Vagina - Which latter is surrounded by the sphincter vaginæ muscle, and is partly closed in the virgin by the

Hymen - A fold of mucous membrane usually semilunar with free concave border turned upwards towards pubes; sometimes absent; sometimes developed into a septum, complete, or with small central, or numerous cribriform apertures; replaced after sexual connection by the *caruncula myrtiformes*, small irregular eminences due to the cicatrisation of the ruptured hymen

par excellence, shorn of its thoroughgoing preface, is an old book now. Holden is no more.* Heath has been seriously damaged.† Gray somewhat so.† Cunningham is taking the place of both. Only the versatile Quain could be transformed.

It is in 1884 that specialism gained official recognition. It is in 1884 that separate examiners in Physiology were appointed by the Colleges of Physicians and Surgeons.

Of course this meant separate examiners in Anatomy also; though few saw it at the time.

Then began our rapid decline, – directly in regard to Anatomy and Physiology,‡ – indirectly in all educational matters.

Freed from the former physiological counterweight, the examiners in Anatomy were more or less led away by the new gospel of specialism. Dazzled by the glittering vistas of the rising school, they became in their turn more or less specialised, more or less distinctly the converts of the enthusiasts (scientific enthusiasts) of the University triposes.§

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* Up to date; † as regards simple dissectional matter. It will be seen in what sense the above criticisms should be read.

Fancy Ellis and Macalister fused into one, – the two royal "Freres Ennemis" (in regard to doctrine) on the same pile, – their very flames parting asunder.

Macalister's Anatomy is a work of genius. It is an admirable book, the grandest, perhaps, of anatomical books extant, but as an *expose* of scientific Anatomy, not of the Anatomy primarily required by the medical man.

‡ Such a thing as a kidney sliced in two was a totally new object to a truly unfortunate candidate duly signed up for the second conjoint examination in July last. The candidate is the son of a brother medical man, and had been for three years at one of the large medical schools. The young gentleman pleaded, – in perfect honesty, no doubt, – that there were many of his mates who hadn't seen a divided kidney any more than he had, – except as a dish on the table!

§ Biology is not to be looked upon simply as a new subject. It is the embodiment of a *new standpoint*, from which the whole of Anatomy is to be looked at in a fresh light: "The necessity," writes Professor Macalister, "of giving the medical student a course of biology before he begins the dissection of the human body, and thus introducing him to an account of the Anatomy of Man studied from the morphological standpoint, and as a member of the great animal series."

Introducing the student to *an account*, such is the true working of the new school. New vistas are aimed at, and as these cannot be opened out through the simple examination of the human body, biology is brought in, – brought in as introducing *an account* of Anatomy. The student is now to learn his Anatomy, – and similarly all other branches of the Curriculum, – largely by listening to his teacher. The new school largely substitutes the activity of the teacher for that of the student. It makes the latter, to use the words of Sir William Stokes, as quoted by Mr. Teale, "a puppet in the hands of others, rather than a self-relying reflecting being."

To afford opportunity to drive in this extended account, the Curriculum must first be lengthened. Then the examinations must be multiplied: The student taught, instead of being left to learn, – taught largely, as in Bible history, by pictures, – cannot be trusted to remember what is, so to speak, merely poured into him, and must be *made* to remember, and to this effect examined at short intervals.

It is quite true that, *in principle*, the new school insists strongly on practical work. "One part dissected with care," writes Prof. Macalister, "is worth a dozen hurried over." Indeed, the zeal and personal example of the Leaders is admirable; but the field of work has been so enormously extended that theory and practice cannot go hand in hand. The noblest aspirations notwithstanding, the *fact* is as above stated.

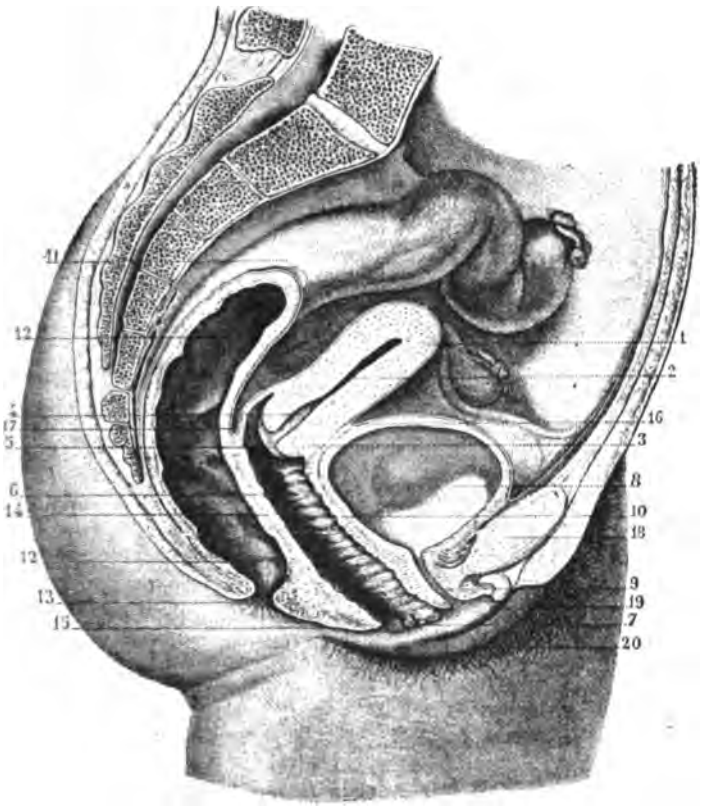


FIG. 357C.—SAGITTAL SECTION SHOWING FEMALE PELVIC ORGANS. (Sappey.)

1, 2, 3, 4, 5, uterus, fundus, body, neck, cavity and os tincæ; 6, 7, vagina and vulva; 8, 9, bladder, urethra; 11, 12, 13, rectum and anus; 10, 14, conjoined vesico-vaginal and recto-vaginal walls; 15, perinæum; 16, 17, utero-vesical and recto-vaginal pouches; 18, symphysis pubis.

FIG. 357D.—FROZEN SECTION OF SAME PARTS, DIAGRAMMATIC.

THE UTERUS.

Pear-shaped & flattened from before backwards.
Lies between bladder & rectum, projects inferiorly into upper end of vagina, and is maintained in position by its broad & round ligaments. Presents -

Fundus - broad & rounded, directed upwards & forwards, covered with peritoneum; a little below level of brim of pelvis.

Body - Narrows gradually from fundus to neck, and presents:

ANTERIOR SURFACE - Flattened, covered by peritoneum in its upper three-fourths; adherent to bladder in its lower fourth.

POSTERIOR SURFACE - Convex, entirely covered by peritoneum, and separated from rectum by convolutions of small intestine.

LATERAL MARGINS - Rounded from before backwards, concave from above downwards. Give attachment superiorly to the Fallopian tube, and below that to the round ligament in front, & the ligament of the ovary behind.

Cervix, or Neck - Constricted. Gives attachment to upper end of vagina, which canal extends a greater distance upwards behind than in front.

Vaginal Extremity - Free. Presents the *os uteri* bounded by a thick anterior, and a thin & narrow posterior lip.

Cavity - Very small in comparison with size of organ, and flattened from before backwards, triangular in body, fusiform in neck, the two parts of the cavity being separated by a constriction, the *os internum*, somewhat narrower than the *os externum*. The cavity of the body is prolonged at each superior angle into an infundibuliform process, at the apex of which is the minute opening of the Fallopian tube. The cavity of the cervix presents on each wall a prominent median raphé, the *stem*, from which small oblique rugæ, *the branches of the arbor vitæ*, proceed downwards & outwards. The so-called *ovulæ Nabothi*, closed & distended follicles, at one time mistaken for ova, are frequently seen among the above rugæ.

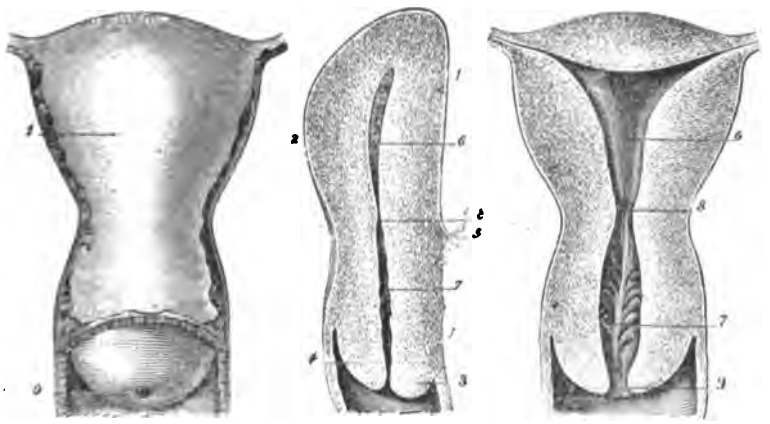
LIGAMENTS OF THE UTERUS — Eight in number of which six, the anterior, posterior, & transverse, are formed by the peritoneum.

ROUND LIGAMENTS - V. next Tablet but one.

ANTERIOR LIGAMENTS - The margins of the utero-vesical pouch of the peritoneum.

POSTERIOR LIGAMENTS - The margins of recto-vesical pouch.

TRANSVERSE LIGAMENTS - Formed by the peritoneum extending from side of uterus to side of pelvis; their free margin contains from before backwards the round ligament, Fallopian tube, & ovary.



FIGS. 357E, F, G.—THE VIRGIN UTERUS: FRONT VIEW, ANTERO-POSTERIOR, AND TRANSVERSE SECTIONS. (Sappey.)

1, 2, 3, 4, anterior and posterior aspects; anterior and posterior lips of os tincæ; 5, recto-vesical cul-de-sac; 6, 7, cavity of body and cervix, the latter showing the arbor vitæ; 8, 9, os internum, os externum.

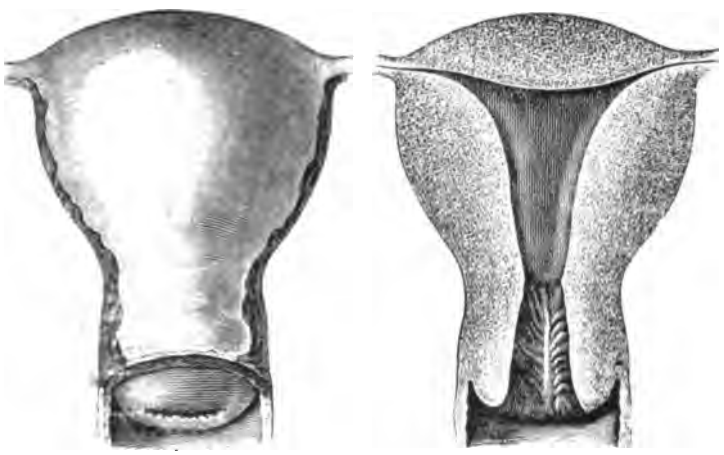
VARIATIONS of the UTERUS ACCORDING to

Age - In the infant the neck is larger than the body, and the organ lies above the brim of the pelvis. At puberty the uterus is pyriform in shape; it has descended into the pelvis, and the arbor vitæ is well marked. In old age, the uterus becomes pale, dense & atrophied; the body & the cervix become less distinct; both the os internum & the os externum diminish in size and sometimes close; the labia of the os externum almost entirely disappear.

Menstruation - At each period, especially when menstruation is first established, the uterus becomes enlarged, & more vascular; the os externum, more rounded, & its labia turgid & swollen; the mucous membrane of the cavity, thicker, softer & darker in color.

Pregnancy - During pregnancy the mucous membrane of the uterus becomes thick, soft & vascular, and is soon differentiated into decidua reflexa, decidua serotina, & decidua vera. The muscular structure increases both by new formation and by the hypertrophy of its pre-existing elements until about the sixth month, the weight of the uterus increasing from about an ounce to from 1½ to 3 lbs.; the subsequent enlargement of the uterus is due to distention. In shape the body becomes more rounded and more directly continuous with the cervix, and towards the close of gestation the cervix itself becomes distended, and its cavity becomes continuous with that of the body. While thus increasing in bulk, the uterus makes its way between the layers of its broad ligaments, and, after first sinking somewhat within the cavity of the pelvis, it subsequently rises into the hypogastric region & into the lower part of the umbilical

Parturition - Brings about the partial return to the virgin state. The weight of the uterus usually remains, however, from two to three ounces; its cavity, larger; its os externum, wider and more transverse with its margins puckered & fissure



FIGS. 357II, I.—THE UTERUS IN THE MULTIPARA. (Sappey.)

THE APPENDAGES of the UTERUS.

Are the round ligament, the Fallopian tube, and the ovary & its ligament, which lie, in the above-mentioned order from before backwards, in the broad ligament of the uterus, the Fallopian tube occupying the free margin of that ligament. Between the ovary & the Fallopian tube is also the organ of Rosenmüller.

Round Ligament - Commences at superior angle of uterus, passes outwards & forwards between folds of broad ligament below & in front of Fallopian tube, traverses inguinal canal, and becomes lost in corresponding labium major. It contains a few muscular fibres prolonged from the uterus, & a few twigs from the ovarian arteries. In the fœtus a tubular process of peritoneum, the canal of Nuck, accompanies it in the inguinal canal; but this process is generally obliterated in the adult.

Fallopian Tube, or Oviduct - Commences at superior angle of uterus by a very minute opening, the *ostium internum*, and its canal remains very narrow along inner half of the tube. Passing outwards in free margin of broad ligament, and then curving downwards & backwards towards ovary, it gradually expands into a wide trumpet-shaped extremity *(fimbriated extremity or morsus diaboli)*, surrounded by a series of fringe-like processes, the *fimbriæ*, one of which is attached to the outer end of the ovary; the opening of which extremity, termed the *ostium abdominale*, is, however, somewhat contracted. - In structure it presents:

Serous Coat.

Muscular Coat - Consists of external longitudinal & internal circular fibres derived from the uterus.

Mucous Coat - Covered with columnar ciliated epithelium, and thrown into numerous longitudinal folds, which folds are thick & broad in the outer & wider part of the tube, and narrower & broken up into delicate arborescent processes in the inner & narrow part. This coat is continuous externally with the peritoneum.

Ovary - Oval, flattened from above downwards. Lies in posterior part of broad ligament, below & behind the Fallopian tube; and is attached internally to the uterus by the ligament of the ovary, and externally to one of the fimbriæ of the morsus diaboli (*see* p. 152*q*). It is whitish in colour, and its surface is smooth in the child, uneven & puckered in the adult.

Ligament of the Ovary - Rounded bundle of fibrous tissue & muscular fibres, the latter derived from the uterus, extending from superior angle of latter organ to inner extremity of ovary.

Organ of Rosenmüller or Parovarium - A group of closed tubules lined with epithelium, scattered transversely in broad ligament of uterus between Fallopian tube & ovary, and connected together internally by a larger vertical tube, which descends for some distance along side of uterus. Is probably a remnant of the Wolffian body.

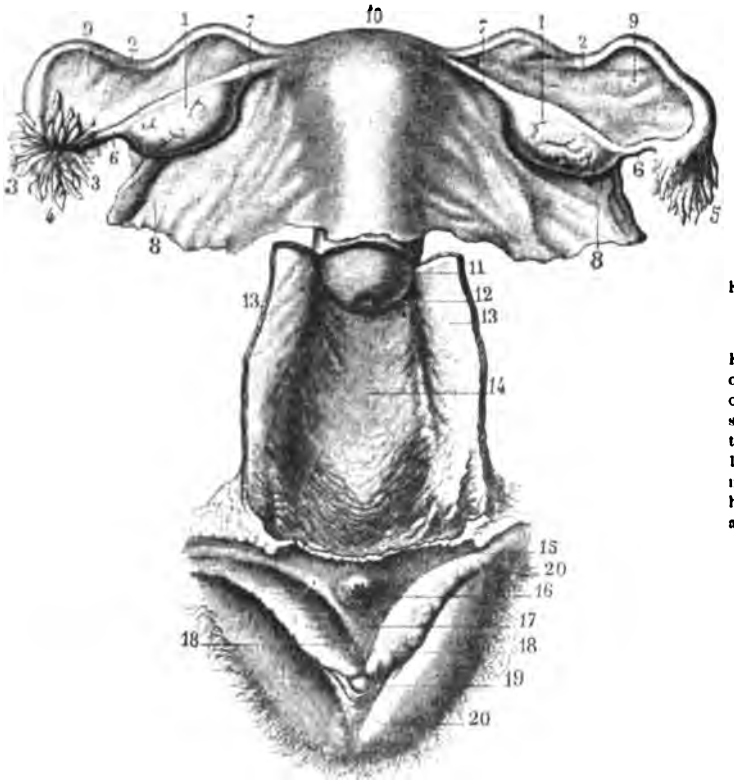


FIG. 357J.—POSTERIOR VIEW OF DETACHED FEMALE GENITAL ORGANS. (Sappey.)

1, 7, ovary and its ligament; 2, 3, 4, 5, Fallopian tube with anterior and posterior aspects of fimbriated extremity, ostium abdominale; 6, ovarian fimbria; 8, 9, broad ligament and mesosalpinx; 10, 11, 12, uterine fundus, neck, and os tincæ; 14, 15, posterior wall of vagina; 16, 17, 18, 19, 20, meatus urinarius, vestibule, labia majora and minora, and clitoris; these structures have been detached from the rami of the pubes and ischia, and turned downwards and backwards.

FIG. 357K.—THE SAME STRUCTURES, SHOWING THE PAROVARIUM, k. (Ellis.)

BLADDER, URETHRA, RECTUM.

BLADDER — Is normally smaller than in the male, though sometimes larger through distention, and is very broad from side to side. Its posterior surface comes in contact with the uterus, and its base rests upon the vagina & the lower part of the cervix uteri. Its other relations are the same as in the male.

URETHRA — Is about an inch & a half long and very dilatable. It passes downwards & forwards in the anterior wall of the vagina, being slightly curved with concavity upwards. It perforates the triangular ligament as in the male, and is surrounded by the compressor urethræ muscle. – In structure it presents from without inwards: –

1. *Muscular coat* – Consists of a thick layer of circular fibres continuous with those of bladder.
2. *Thin layer of erectile tissue*
3. *Mucous membrane* – Covered with squamous epithelium, except near the bladder, where the epithelium is spheroidal, and thrown into numerous longitudinal folds, of which one, situated on the floor of the canal, more or less resembles the verumontanum of the male

RECTUM — Is less curved and more capacious. The first & third portions are similar to what they are in the male. The second portion is adherent inferiorly to the anterior wall of the vagina, and superiorly is less completely invested by peritoneum.

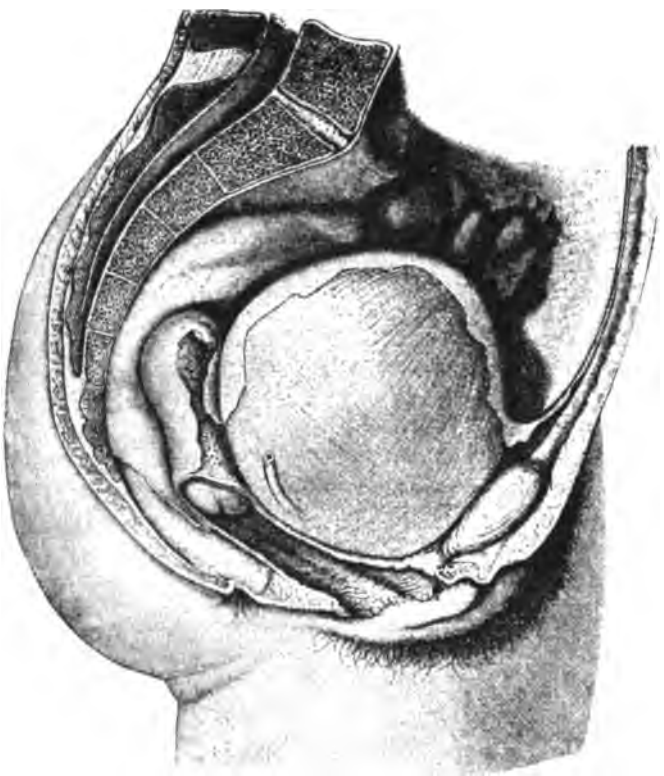


FIG. 357L.—RELATIONS OF THE DISTENDED BLADDER. (Sappey.)

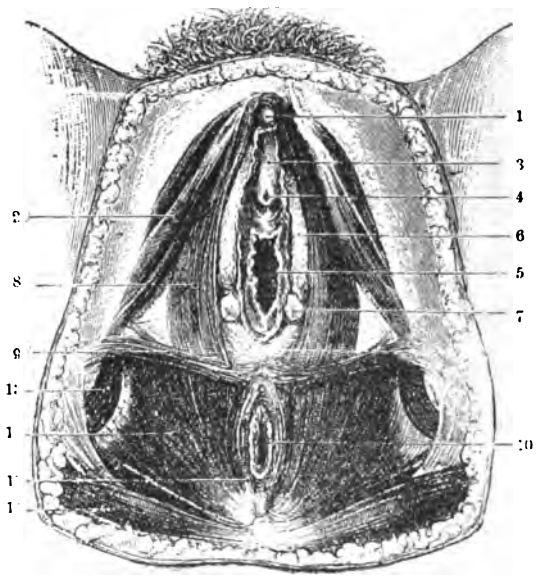


FIG. 357M.—DISSECTION OF THE FEMALE PERINÆUM. (Heath, Savage.)

1, 2, clitoris and erector clitoridis; 3, 4, vestibule and meatus urinarius; 5, 6, 7, 8, vaginal orifice, bulbus vestibuli, gland of Bartholin, and bulbo-cavernosus muscle; 9, transversus perinæal muscle; 10, 11, 12, anus, with the external sphincter and levator ani muscles, the latter showing its white line of origin, which crosses the obturator internus muscle, 13; 14, gluteus maximus muscle.

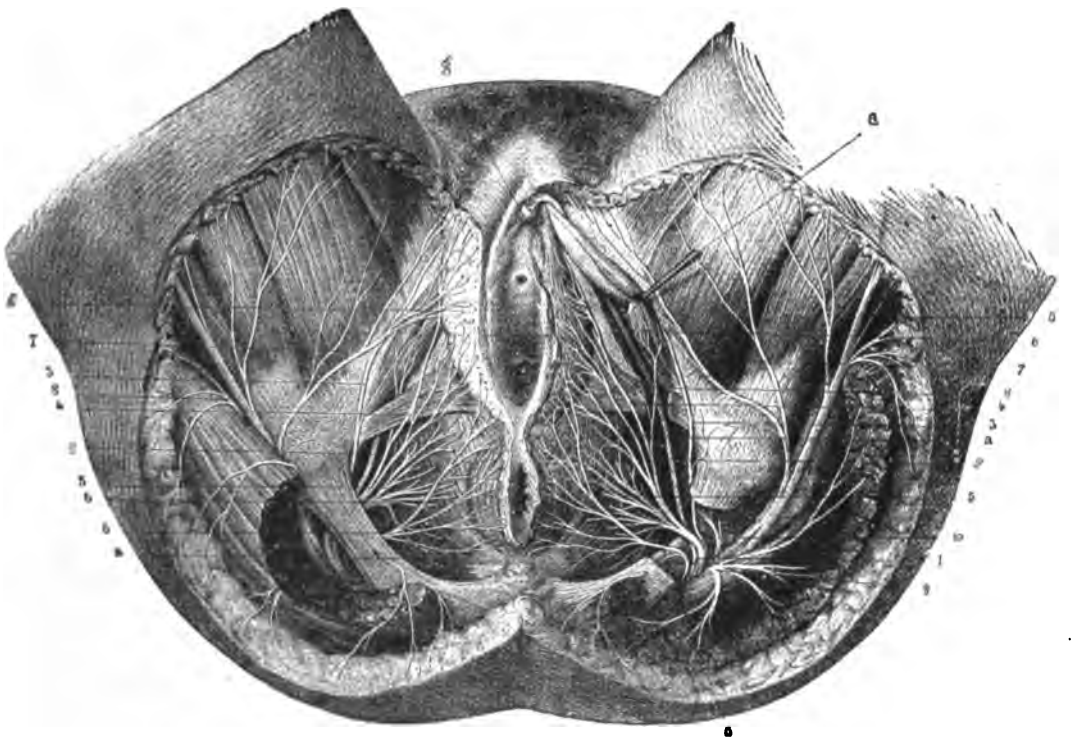


FIG. 357N.—THE PUDIC NERVE IN THE FEMALE. (Hirschfeld.)

1, 2, its superficial and deep branches, or perinæal nerve and dorsal nerve of clitoris, - the former dividing into external perinæal nerve, 3, and the superficial and deep internal perinæal nerves, 4 and 5; 6, nerve to the levator ani; 8, 7, 9, small sciatic nerve and its inferior pudendal and superficial gluteal branches; 10, nerve to obturator internus; *a*, *b*, levator and sphincter ani; *c*, *d*, *e*, sphincter vaginæ (bulbo-cavernosus), erector clitoridis, and transversus perinæi, the latter divided on left side; *f*, adipose tissue of labium; *g*, clitoris receiving its dorsal nerve.

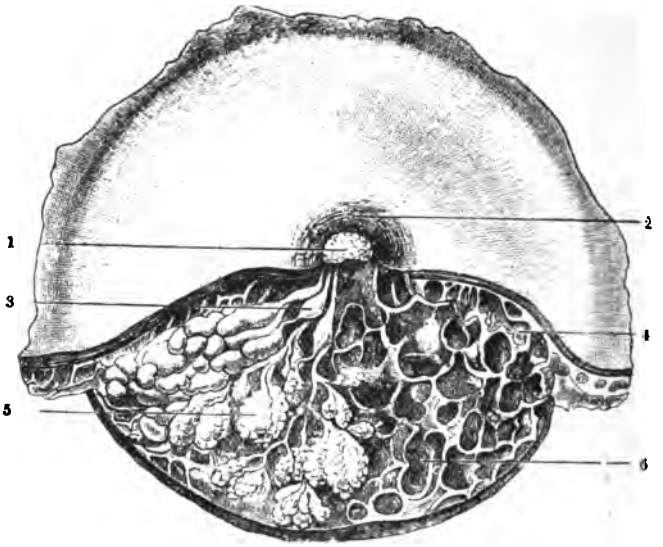


FIG. 3570.—THE MAMMA. (Heath, after Lushka.)

1, 2, nipple, areola; 3, 4, 5, 6, ampulla of duct, subcutaneous fat loculi, acini, and gland loculi.

THE MAMMA.

Rudimentary in the male, small in the female before puberty: increases in size during pregnancy & after delivery. – Presents:

POSTERIOR SURFACE, or BASE — Somewhat concave; nearly circular, but slightly elongated from below upwards & outwards. Rests upon pectoralis major & fascia covering it, and extends from 3rd rib to the 6th or 7th, and from side of sternum to axilla.

ANTERIOR SURFACE — Presents, a little below its middle, the nipple surrounded by the areola.

Nipple - Cylindrical or conical; presents at its apex the openings of the lactiferous ducts. Its surface is of a pink or brownish hue, wrinkled, provided with papillæ, and, near its base, with some sebaceous glands. It is susceptible of a sort of erection due mainly to the contraction of its muscular fibres.

Areola - Rosy in the virgin; larger & darker in colour after the second month of pregnancy & during lactation (when its sebaceous glands enlarge considerably), and also somewhat so during the remainder of life

NOTES ON THE NEWER MATTER.

Figures 357A and B show the pudendum as seen when the lower limbs are abducted, the only position of the person in which the pudendum can be seen at all, and when the labia are more or less parted. There is then no such thing as a uro-genital space or vulval cleft, – these resulting from the parts being pressed together in the adducted position of the thighs.

The remarks apply to the female organs, which were made on pp. 152c to e in regard to the bladder and rectum in the male sex.

The walls of the female urethra are approximated from before backwards. The canal is extremely dilatable: it will admit of the steady and gradual introduction of the index finger without this causing any permanent incontinence.

Sectional anatomy (sections of frozen or otherwise hardened structures) seems to show that the vagina is shorter (2½ and 3½ inches along its anterior and posterior walls, respectively), less inclined, and less curved than is generally believed. It is nearly straight, and approximately parallel in direction to the plane of the pelvic inlet, and nearly at right angles to the usual direction of the cervix uteri. The distended bladder resting on the passage renders it more horizontal; the distended rectum raises it somewhat. The passage is flattened from before backwards in the greater part of its extent, rounded superiorly to receive the neck of the uterus; inferiorly it is H-shaped on transverse section.

The true position of the uterus has long been a warmly contested point. It is apparently established that the usual direction of the cervix is nearly at right angles to the vagina, as above stated. Though shorter, and projecting less into the vagina, the anterior lip of the os thus lies on a lower level than the posterior lip. The uterus appears to be, normally, both anteverted and anteflexed. Its exact position depends largely, however, on the conditions of emptiness or distention of the bladder and the rectum. The uterus is pushed backwards by the distended bladder, forwards by the distended rectum. With both a distended bladder and an empty rectum, the direction of the uterus may be almost parallel to that of the vagina.

up in all the necessary knowledge in six months. These were not the examinations in a man's knowledge of disease." (Hansard's Reports.)

Continued the *Lancet*:

"The general and medical Press of the country is unanimous in blaming the Council for the defects which still exist in medical education, and which are complained of in Parliament. These complaints are a scandal to the profession. After Sir John Gray's statement in Parliament—a Cabinet Minister said, 'What a dangerous thing it must be to call in a doctor!'"

"We believe that there never were a greater number of well-educated and intelligent medical men than there are to-day; still it is fact that men whose medical education, for practical purposes, is little else than a farce," &c.

But Parliament and the *Lancet* were out by a year.

In June, 1868, the General Medical Council had got resolutely into harness in regard to Medical Education:—

"Resolved—'That a Committee be appointed to consider and report how the various subjects of the Medical Education may be taught with most advantage; in what order they should be studied; and how the examinations in them ought to be arranged;'"

and by July 10, 1869, they had issued perhaps the grandest Report on Medical Education that has ever seen the light of day, upon which, as says Sir Richard Quain, all subsequent legislation has been based.*

A NOTE TO PAGE 10.—An entirely new book by a talented writer of the New School—Prof. Halliburton, of King's College—was produced in 1896, under the title of "Kirkes' Physiology." The remarks on page 10 apply, not to this work, but to the several editions of Kirkes' Physiology published before 1896. It is a recent custom, and to the author's mind not a good one, that the title of a successful book should—as a kind of valuable asset belonging to the publisher—be detached, after a number of years, from the original book, and tacked on, as an attractive label, so to speak, to a book of different character, and by a different author, or different authors. It is certainly not of the "New Kirkes" that it is suggested that it might excite a smile; it is an extremely well-written book, quite on New School lines.

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* The Report embodied the replies, on almost every subject of the Medical Education, of a hundred and thirty of the leading teachers, among whom were Mr. John Attfield, Sir Benjamin Brodie, George Viner Ellis, Dr. Lionel Beale, Dr. Cleland, Mr Luther Holden, Sir George Humphry, Dr. Redfern, Dr. Rolleston, Dr. Struthers, Sir William Turner, Dr. Anstie, Sir William Garrod, Dr. Sieveking, Dr. Sidney Ringer, Dr. Aitken, Dr. Wilson Fox, Sir William Gull, Sir Thomas Watson, Sir Samuel Wilks, Mr. Christopher Heath, Sir John Erichsen, Sir William Fergusson, Sir Joseph Lister, Mr. John Marshall, Mr. Campbell De Morgan, Sir James Paget, Sir William Savory, Mr. Pridgin Teale, Sir G. Prescott Hewett, Mr. Berkeley Hill, Mr. Simon, Mr. James Spence, Dr. Heron Watson, Dr. Joseph Bell, Dr. Matthews Duncan, Dr. Grnily Hewitt, Dr. Robert Barnes, &c., &c.

PRACTICAL QUESTIONS ON PART II.

UPPER LIMB.

1. Feel the coracoid process, and demarcate the coraco-acromial ligament.

2. Feel, or indicate the position of, the greater & lesser tuberosities of the humerus, and the bicipital groove.

3. Explore the axilla, feeling specially for enlarged glands; name the muscles which form the folds of the axilla. What are the levels of the boundaries of the axilla?

4. Draw the line of the axillary artery, feel its pulsations, and compress it in the axilla. Compress it with Esmarch's india-rubber tubing, having first rendered the arm bloodless.

5. Draw the line of the circumflex nerve. Show where, and explain how, it emerges from a well-known space at the back of the axilla.

6. Draw the line of the musculo-spiral nerve.

7. Apply a tourniquet to the brachial artery in the middle of the arm. How would you tie the artery in this situation?

8. Trace the course of the cephalic & basilic veins, and map out the cutaneous veins at the bend of the elbow. Give the relations of the median basilic vein; what serious accident may occur in bleeding from this vein?

9. Map out the triangular space at the bend of the elbow with the tendon of the biceps & the bicipital fascia, the median nerve and the brachial artery. Feel the pulsations of the brachial artery in the situation named. Stop the circulation in the artery by forcible flexion of the elbow.

10. Name the arterial anastomoses round the elbow. Point out the nerves round the elbow, other than the median.

11. Examine an elbow-joint for supposed disease or injury. Point out the relations of the internal & external condyles, and of the head of the radius; also those of the olecranon in the several positions of the joint.

12. How would you perform excision of the elbow-joint? How, in that operation, would you guard against injury of the ulnar nerve?

13. Point out the position of the supra-condylar lymphatic gland.

14. Draw the lines of the radial artery and radial nerve. Show in what part of the forearm the nerve accompanies the artery. How would you tie the radial artery in the several parts of its course?

15. Draw the lines of the ulnar nerve and ulnar artery in the forearm, showing where they meet. Where and how would you tie the ulnar artery?

16. Show in action the flexor carpi radialis, palmaris longus, and flexor carpi ulnaris; and mark the position of the median nerve above the wrist.

17. Feel the head of the ulna and its styloid process. Feel the lower extremity of the radius and its styloid process. Which styloid process lies lowest? Name, and show in action, the tendons which groove the above.

18. Show the hollow of the "anatomical snuff-box." Draw the line of the radial artery in that situation. What superficial vein crosses it? Feel the joint of the metacarpal bone of the thumb.

19. Examine the wrist for supposed Colles's fracture. Demonstrate the relative positions of the two styloid processes (by grasping the wrist from side to side between thumb & index, with *finger-nails turned towards patient*).

20. Feel the tubercle of the scaphoid and the ridge of the trapezium; also the pisiform bone, and the unciform process of the unciform. Feel the cuneiform bone at the back of the wrist.

21. Show the position of the medio-carpal & radio-carpal joints, and the upper border of the anterior annular ligament of the wrist.

22. Point out in the palm of the hand the furrow which is of some use as a landmark, and state its significance.

23. Draw the line of the superficial palmar arch, and those of its superficial palmar interosseous or digital branches. Show the position of the deep palmar arch. What incisions can you safely make in the palm of the hand?

24. Mark out the synovial sheaths of the flexor tendons at the wrist and in the palm of the hand. Mark out the sheaths of the extensor tendons.

25. Draw the lines of the digital joints.

LOWER LIMB.

44. Feel the pulsations of the femoral artery on the brim of the pelvis and trace the course of the artery. Show in what places you can compress it. Compress it with Esmarch's india-rubber tubing, having first rendered the limb bloodless. Show the position of the femoral vein & anterior crural nerve.

45. So place the patient as to make evident the sartorius muscle.

Define its relations to the femoral artery in Scarpa's triangle and in Hunter's canal. Where is the femoral vein in Hunter's canal? What nerve accompanies the artery, and where does it lie?

46. Put your finger on the saphenous opening. Explain its mode of formation, and the coverings of femoral hernia.

47. Point out situation of the femoral ring. What are its boundaries? Refer especially to the abnormal obturator artery.

48. Point out the great trochanter, and apply Nelaton's and Bryant's tests as to shortening of the lower limb. Compare the two limbs as to length.

49. Feel, or indicate the position of, the inguinal & femoral lymphatic glands.

50. Trace the course of the internal saphenous vein.

51. Show where the gluteal & sciatic arteries emerge from the pelvis.

52. Draw the line of the great sciatic nerve. How would you expose it?

53. Indicate the position of the bursa patellæ. What serious accident may occur in removing a hypertrophied bursa?

54. Mark the outline of the synovial membrane of the knee-joint, and examine the knee for fluid in the joint.

55. Point out the adductor tubercle.

56. Mark out the boundaries of the popliteal space, and identify the tendons of the biceps, semitendinosus & semimembranosus, gracilis, and the ilio-tibial band.

57. Draw the line of the popliteal artery. What are its relations to the popliteal vein and to the internal popliteal nerve? Mark the position of the external popliteal nerve.

58. Indicate the bursæ at the back of the knee-joint. Which bursæ communicate, or may communicate, with the knee-joint?

59. Indicate the level at which the popliteal artery divides into anterior & posterior tibial, and the level at which the peroneal artery is given off from the latter.

60. Draw the line of the anterior tibial artery, and mention the muscles between which it lies in the upper, middle, and lower parts of its course. Where can you feel its pulsations? What is the relation of the anterior tibial nerve to the artery?

61. Draw the line of the posterior tibial artery. Feel its pulsations behind the internal malleolus. What are its relations to neighbouring structures in this situation?

62. Mark out the subcutaneous surface in the lower fourth of the fibula, and mention the muscles in front of and behind the bone at this level.

63. Show how you would put up a fractured leg. What part of the foot should be in a line with the inner border of the patella? What part should be in a line with the apex of the patella, the patellar ligament, and the spine of the tibia?

64. Mark the line of the ankle-joint, and show the position of the several fasciculi of the internal & external lateral ligaments.

65. Note the position of the internal & external malleoli, and draw the lines of the incisions for Syme's and Pirogoff's amputations.

66. Identify the following tendons :—Tibialis anticus, extensor proprius pollicis, extensor longus digitorum, peroneus tertius; peronei longus & brevis; tibialis posticus & flexor longus digitorum.

67. Draw the line, and feel the pulsation of the dorsalis pedis artery. Between what structures does it lie?

68. Draw the venous arch on the dorsum of the foot, and show the position of the internal & external saphenous veins in the vicinity of the ankle; also the position of the corresponding nerves. Trace the external saphenous vein to its termination.

69. Mark out, on the inner side of the foot, the lesser process of the os calcis, the tubercle of the scaphoid, the internal cuneiform bone, and the base of the first metatarsal bone.

70. Mark out, on the outer side of the foot, the tubercle of Chopart, and the base of the fifth metatarsal bone.

71. Draw the lines of the medio-tarsal and tarso-metatarsal articulations.

72. Draw the lines of the internal & external plantar arteries.

ABDOMEN.

26. Point out the lineæ transversæ and semilunares.

27. Show the direction of the fibres of the external oblique muscle; also of the internal oblique & transversalis, especially where they unite to form their conjoined tendon.

28. Feel the spine, crest, and symphysis pubis.

29. Map out the inguinal canal, and show the position of its rings.

30. Get your finger in the external abdominal ring, and describe what you feel.

31. Trace the course of the deep epigastric artery, its relations to the internal abdominal ring, and to oblique and direct inguinal herniæ.

32. Mark the point where the aorta bifurcates, and draw the lines of the common & external iliac arteries. How would you cut down upon these arteries?

33. Mark the position of the cardiac & pyloric orifices, and the portion of the stomach which is most accessible to the surgeon. How would you open the stomach?

34. Mark out the liver, and the fundus of the gall bladder.

35. See whether the spleen is enlarged.

36. How would you tap the bladder above the pubes? What is the essential difference between the old and the modern methods of supra-pubic lithotomy? How would you perform the latter operation?

37. Examine this patient for varicocele, and carefully isolate the vas deferens.

38. Mark out the kidneys; draw the incisions for cutting down upon the kidney, and for lumbar colotomy.

PERINÆUM.

39. Mark out the boundaries of the perinæum and those of the ischio-rectal fossa. Why is it specially urgent to open at once an abscess of the margin of the anus? Mark the position of the lower border of the gluteus maximus when the body is in the lithotomy position.

40. Put your finger on the central tendinous point of the perinæum. Draw the line of the incision for lateral lithotomy.

41. Pass your finger up the rectum, and examine for piles. See whether the prostate is enlarged. Feel for the fluctuating distended bladder behind the prostate, and between the vesiculæ seminales & vasa deferentia. How, and when, would you puncture the bladder in this situation?

42. Feel for the apex of the prostate, and explain how you would open the urethra in this situation (Cock's operation).

43. Point out the median raphé of the perinæum, and show where, and how, you make the incision for perinæal section.

APPENDIX.

STERNO-CLAVICULAR ARTICULATION

Is an articulation by reciciprocal reception (Cruveilhier) between the clavicular facet of the sternum & the inner extremity of the clavicle, or rather, as is remarked by Gosselin, between the clavicular facet of the sternum & the inner surface of the interarticular fibro-cartilage. Between these two latter articular surfaces there is a most perfect reciprocal adaptation: - the sternal articular surface is concave from above downwards & outwards and convex from before backwards; the corresponding surface of the interarticular fibro-cartilage is concave from before backwards and convex from above downwards & outwards.

The interarticular fibro-cartilage divides the cavity of the articulation into two parts lined each of them by a separate synovial membrane. The synovial membrane between the sternum & the interarticular fibro-cartilage is the largest; the other one is prolonged between the contiguous articular surfaces of the clavicle & of the first costal cartilage. - The interarticular fibro-cartilage is thickest at its circumference, especially above & behind; its inner surface, as aforesaid, is concave from before backwards & convex from above downwards & outwards. Its outer surface is concave, and is attached to the clavicle at its upper & back part. Its circumference is attached to the capsular & to the anterior & posterior ligaments, and, inferiorly, to the cartilage of the first rib. - Occasionally the fibro-cartilage is perforated in the centre; the two synovial membranes then communicate.

LIGAMENTS - Are:

Capsular - Thin & ill-defined, from
Circumference of inner extremity of clavicle to
Margin of sternal articular facet.

Ant. Sterno-Clavicular - Strong & broad oblique band from
Front of inner extremity of clavicle to
Upper & front part of first piece of sternum.

Post. Sterno-Clavicular - Thinner & narrower; obliquely from
Back of inner extremity of clavicle to
Upper & back part of first piece of sternum.

Interclavicular - Thick flat band, which passes in a curved direction from
Upper part of inner extremity of one clavicle to
Upper part of inner extremity of other, being closely connected with the upper margin of the sternum.

Costo-Clavicular or Rhomboid - Short flat cord from
Upper & inner part of cartilage of first rib to
Rhomboid impression on under surface of clavicle.

This ligament belongs, properly speaking, not to the sterno-clavicular but to the costo-clavicular articulation. It is usually described here, however, as it contributes materially to retain the clavicle in its situation. - The costo-clavicular articulation is, in fact, a part of the sterno-clavicular, and the articulation of the inner extremity of the clavicle might well be called the *sterno-costo-clavicular*.

MOVEMENTS — The sterno-clavicular or sterno-costo-clavicular articulation admits of movements in every direction, circumduction included, these movements are not extensive, however, being limited, by the connexion of the clavicle with the scapula & the upper limb. - The interarticular fibro-cartilage moves with the inner extremity of the clavicle, gliding freely on the articular surface of the sternum.

ACROMIO-CLAVICULAR ARTICULATION

Is an arthrodial articulation.

ARTICULAR SURFACES — Are small, flat, elongated from before backwards, and oblique downwards & inwards.

LIGAMENTS:

Sup. Acromio-Clavicular – Strong broad band, from
Upper part of outer end of clavicle to
Adjoining part of upper surface of acromion.

Inf. Acromio-Clavicular – Similar to, but thinner than, preceding, from
Under part of outer end of clavicle to
Adjoining part of under surface of acromion.

Coraco-Clavicular – Does not properly form part of the articulation but is usually described with it, as it powerfully assists in retaining the clavicle in its normal position. Consists of two fasciculi, the

TRAPEZOID LIGAMENT – The most anterior & external, quadrilateral, from
Upper surface of coracoid process to
Oblique line on under surface of clavicle – Is joined to the following by its posterior border;

CONOID LIGAMENT – Posterior & internal to foregoing, and conical with base upwards, from
Base of coracoid process to
Conoid tubercle on under surface of clavicle.

INTERARTICULAR FIBRO-CARTILAGE — Wedge-shaped with base turned upwards and attached to superior coraco-clavicular ligament. Is frequently absent, and rarely divides the articulation into two cavities, so that there is generally but one synovial membrane.

PROPER LIGAMENTS of the SCAPULA

Are two in number.

Anterior, or Coraco-Acromial – Broad, thick, triangular; from
Apex of acromion to
Whole length of outer border of coracoid process. – It completes the vault formed by the coracoid & acromion processes above the head of the humerus, and prevents dislocation of the humerus upwards. – A bursa is interposed between it and the humerus.

Posterior, Transverse, or Suprascapular – Narrow band from
Base of coracoid process to
Inner margin of suprascapular notch, which it converts into a foramen for suprascapular nerve.

PUDIC NERVE.

From lower part of sacral plexus.

With pudic artery through lower part of great sacro-sciatic foramen on inner side of great sciatic nerve.

Winds round spine of ischium, and re-enters pelvis through lesser sacro-sciatic foramen, where it gives off inferior hæmorrhoidal nerve.

Forwards along outer wall of ischio-rectal fossa above pudic artery, both nerve & artery being covered by obturator fascia, and divides into perinæal nerve & dorsal nerve of the penis.

PERINÆAL NERVE — The larger. Accompanies superficial perinæal artery, and divides into branches: –

Cutaneous or Superficial Perinæal – Two in number:

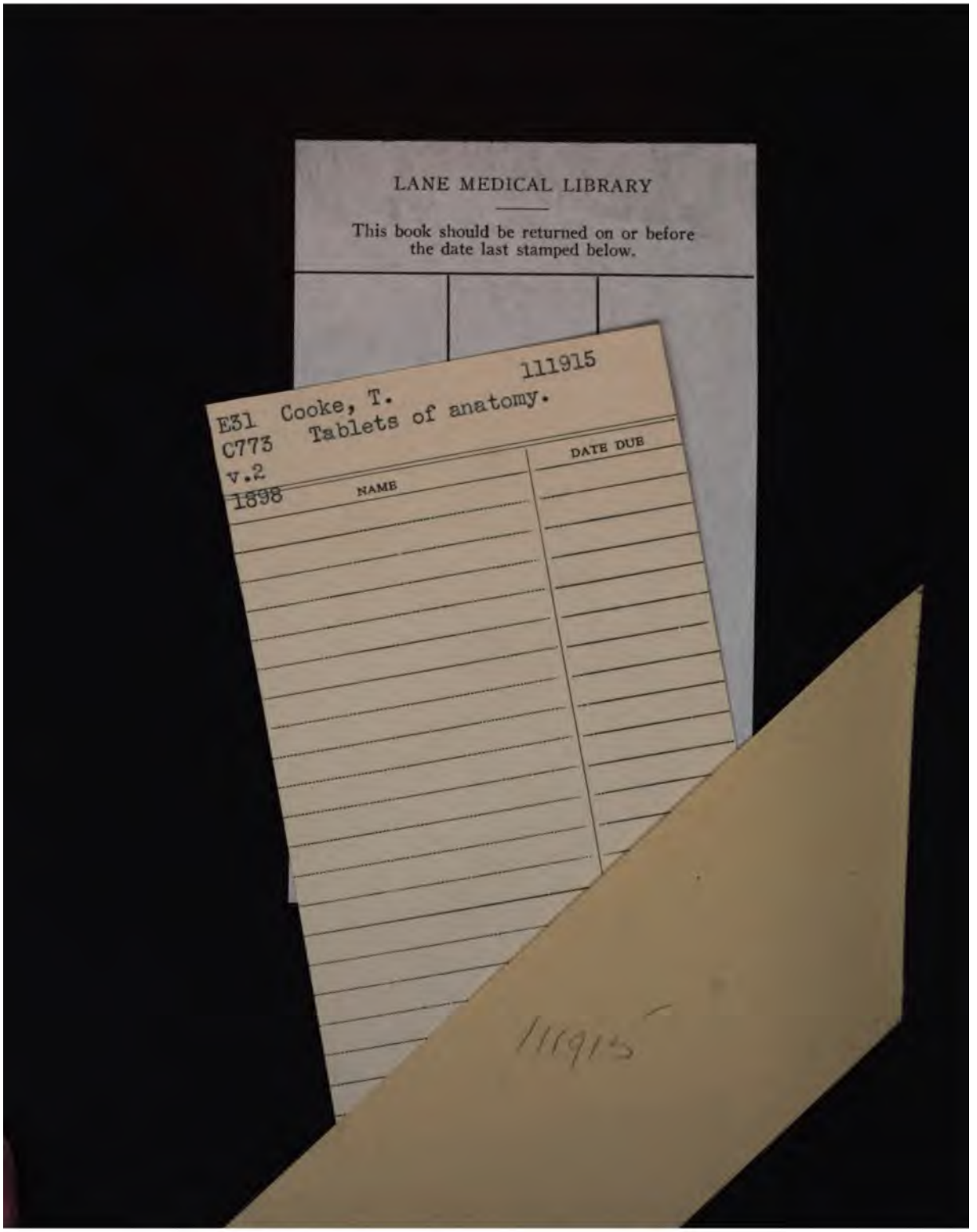
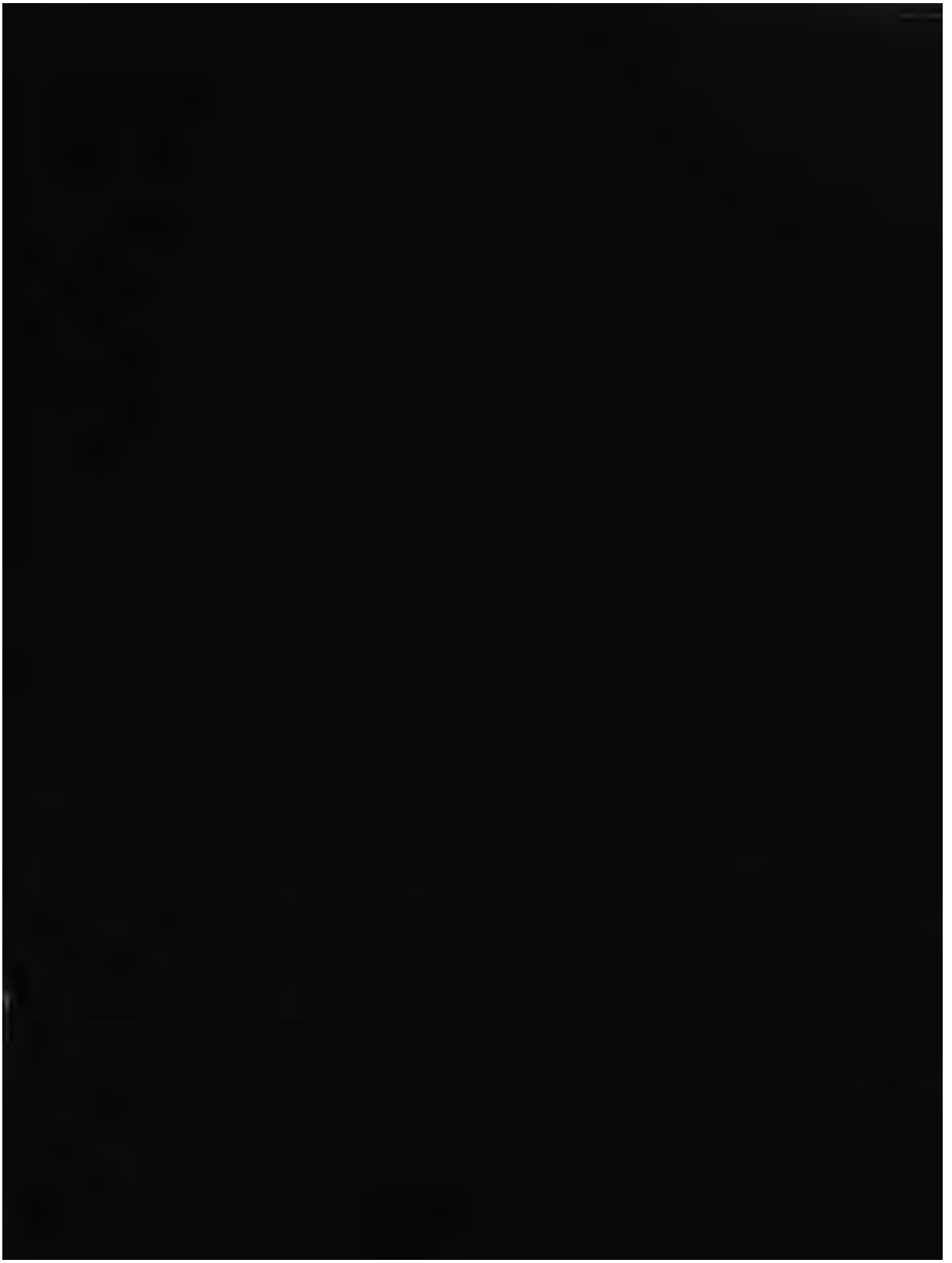
Posterior or Internal – Gives filaments to skin in front of anus (and to the sphincter ani, Gray), and communicates with the inferior hæmorrhoidal nerve. It then passes forwards to the scrotum or labium on the inner side of the following nerve with which it communicates anteriorly.

Anterior or External – Forwards on outer side of foregoing to scrotum & integument of penis, or labium. Communicates with foregoing, and with inferior pudendal, and gives a few twigs to levator ani.

Muscular – Generally arise by a common trunk, which passes forwards and inwards under cover of transversus perinæi, and supplies anterior extremity of sphincter ani, transversus perinæi, erector penis, accelerator urinæ & compressor urethræ; a twig is given to the bulb of the urethra.

DORSAL NERVE OF THE PENIS — The smaller. With pudic artery along rami of ischium & pubes between the two layers of deep perinæal fascia, and through suspensory ligament and along dorsum of penis to glans. Supplies skin of dorsum & sides of penis, and gives a large branch to corpus cavernosum. – *Dorsal nerve of clitoris* in female is smaller, but similarly distributed.

Inferior Hæmorrhoidal Nerve – May be derived directly from sacral plexus. Crosses ischio-rectal fossa towards lower end of rectum, and gives off numerous branches to sphincter ani & integument round anus; communicates with superficial perinæal & inferior pudendal.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